VOL. XV. No. 5. MAY 1930.

MECCANO MAGAZINE

BUILDING WITH STEEL
(see page 354)

6D.

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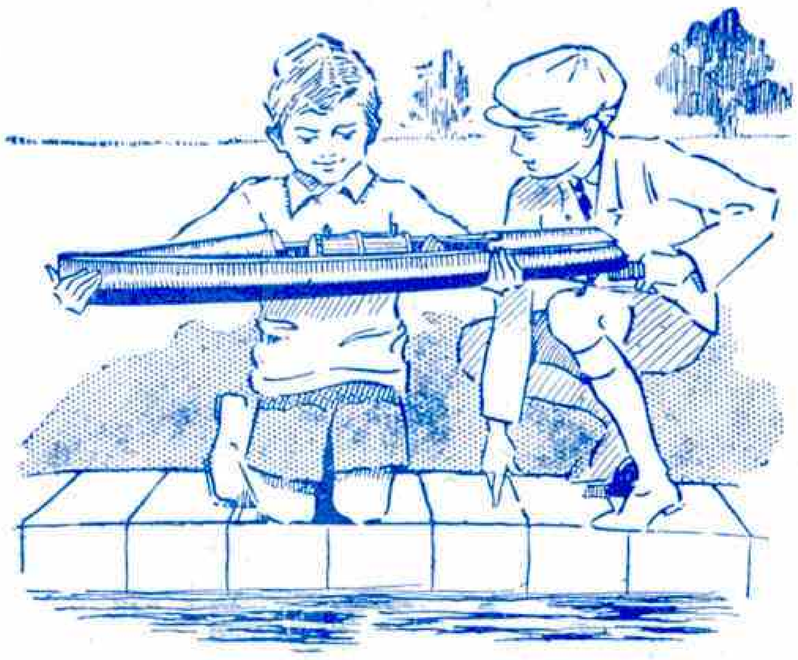

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MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XV. No. 5
May, 1930

With the Editor

Beavers in England

The coming of May always brings to my mind Beverley Minster, one of the finest churches in the country. The reason for this is that the seventh of the month is the day of St. John of Beverley, an old English saint who, for the times in which he lived, was a remarkably learned man.

It is not a desire to inflict a history lesson on my readers that causes me to refer to this saint, however, but to remark that the name Beverley means the "beaver meadow." The district in which the Minster is built was once a haunt of beavers, the animals that seem to find their greatest pleasure in displaying the wonderful skill with which they can build dams across all the streams within their reach.

To-day there are no beavers in England, and there is no doubt that their extinction has helped to change the face of the country. Many parts of our land that formerly were dank morasses have been drained and cultivated, but no amount of drainage would have been of any use so long as beavers remained to obstruct the streams and thus to spread water over the land. Such morasses existed around the Humber and the lower course of the Thames. A very extensive marsh covered the Fens and the neighbourhood of Ely was once an island that could only be reached by boat.

A curious proof of the impassable nature of these morasses may be found in the comparatively small dykes and earthworks that formerly barred the way into Norfolk. These were built across the Icknield Way, an ancient track that ran from Wiltshire into East Anglia. They were so short that at first sight it seems as if it would have been quite simple for forces advancing from the west to have ignored them and to have passed around their northern flanks. But there were beavers in Britain when the dykes were built! This meant that there were marshes, and the extensive morasses of the Fens were sufficient protection against flanking movements.

Discovery of a New Planet

About 85 years ago a young English mathematician named J. C. Adams called at Greenwich Observatory to see the Astronomer Royal. In his pocket was a paper on which were given particulars of a planet then unknown and almost unsuspected, together with information of its approximate whereabouts in the sky, and a suggestion that a careful search would reveal its existence. He left the paper to be given to Sir G. B. Airy, then Astronomer Royal, but unfortunately the latter put it away and at the moment took no further action.

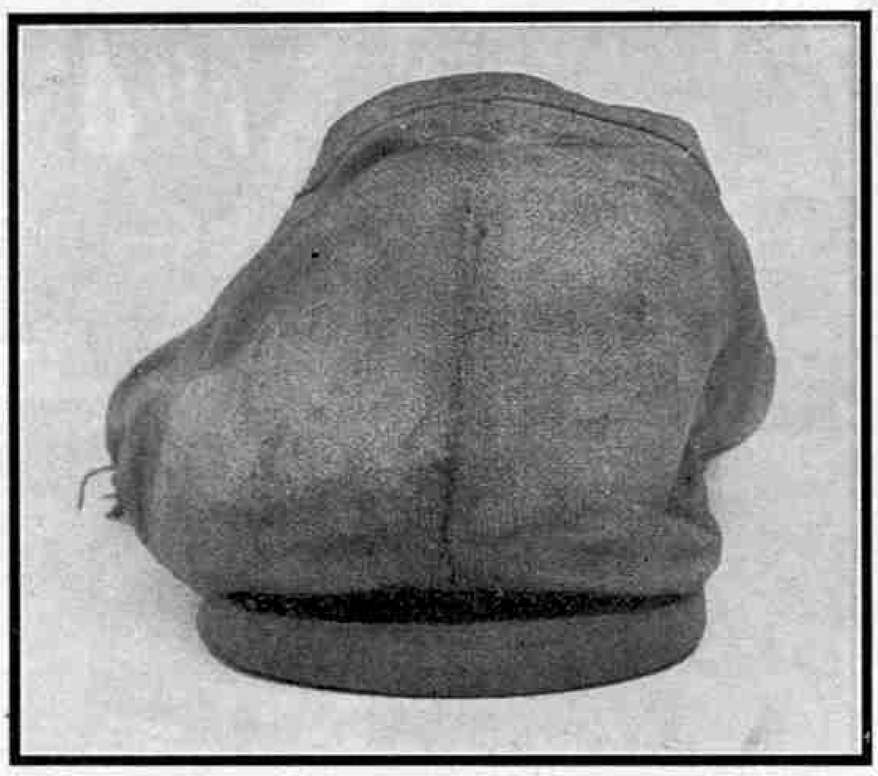
By a strange coincidence, a Frenchman named Le Verrier made similar calculations a few months later. He wrote to the Director of the Berlin Observatory, and was more fortunate than Adams, for a search of the heavens immediately was begun by two assistants at the German Observatory. In the meantime the publication of a paper in which Le Verrier gave his calculations reminded Airy of Adams' paper. He took it out and after studying it asked Professor Challis of Cambridge to look for the supposed planet. By this time it was too late, however, for the possession of a good star map had given the German astronomers a great advantage, and on 23rd September, 1846, the new member of the Sun's family was seen and recognised as a planet for the first time by Galle of Berlin.

The credit for the discovery of the new planet, to which the name Neptune was given, is shared by Adams and Le Verrier, but there is no doubt that it would have been discovered earlier if Airy had ordered a search to be made immediately on receiving Adams' paper. It seems remarkable that Adams himself did not take the trouble to enquire from Airy what action he proposed to take. Probably the reason was that Adams was not an astronomer, but a mathematician, and was far more interested in the calculations than in the actual discovery. An imaginary case would have served his purpose almost equally well, and he had no desire to gain a popular reputation as the result of a sensational discovery.

It seems almost uncanny that an astronomer sitting quietly in his study should be able to calculate the position of an entirely new planet with such accuracy, but as if to show that the power to deal with unseen things is by no means remarkable, Adams' wonderful feat now has been repeated. Many years ago the late Professor Lowell, a well-known American astronomer, calculated the position of yet another planet thought to circle round the Sun at an even greater distance from it than Neptune. Now, a few years after his death, a planet has been discovered in practically the exact position that he gave for it!

In many respects the discovery of Professor Lowell's planet is more remarkable than that of Neptune, for the new body is very much smaller and is millions of miles further away. It cannot be seen with the naked eye, and its existence was first revealed by the appearance of a tiny dot on a photograph of a portion of the sky taken with the aid of a special telescope. Unlike the dots representing the fixed stars in the same neighbourhood, this appeared in slightly different positions on plates exposed at intervals, thus showing it to be a planet, or "wanderer through the sky," as the ancient Greeks called these bodies. The fascinating story of this wonderful discovery will be told in an early issue.

No. 18. WHAT EVER IS IT?



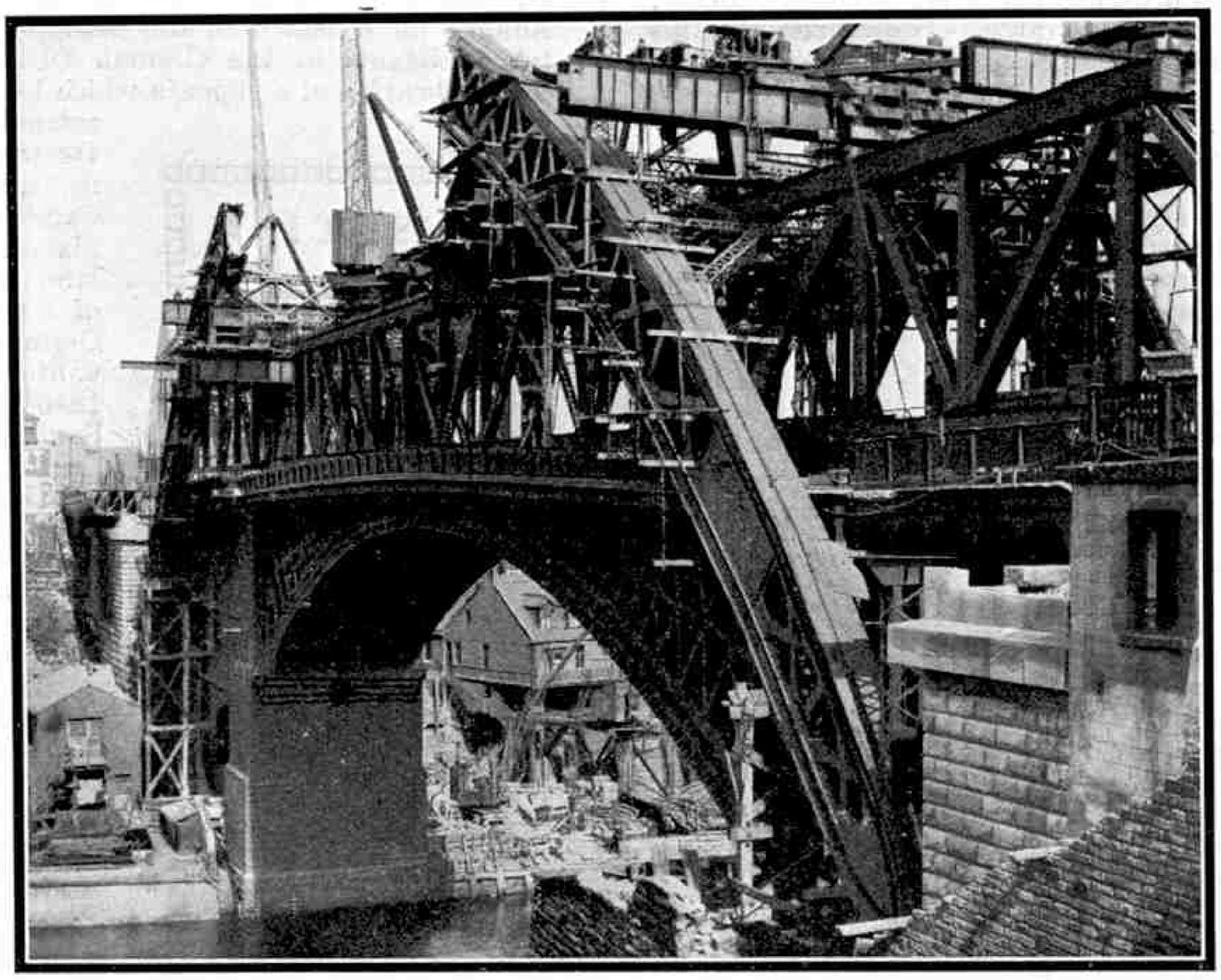
Here is the eighteenth puzzle in the popular series of mystery photographs. Can you identify this mysterious looking object? To the first reader to send an exact answer or, if nobody is successful in this, to the one who gets nearest, I will send an autographed copy of my book "Engineering for Boys." Solutions should be written on postcards only and addressed "Editorial Competition, No. 18, Meccano Magazine, Old Swan, Liverpool." Closing date, 31st May. For result of April Competition see page 432.

Building With Steel

II.—Some Types of Modern Bridge Construction

LAST month we dealt with the use of steel in the construction of large buildings, and particularly those of the "skyscraper" type. This month we shall speak of bridges, which afford still more striking instances of steel succeeding where stone or brick would fail.

Even in the construction of the simplest type of short-span bridge, steel has points of superiority over masonry; but this superiority is most striking in the spanning of big distances at high levels, and often in extremely difficult situations. Take, for example, the great bridge across the gorge of the Zambesi River below the Victoria Falls in South Africa. The problem here was to span a distance of 500 ft. at a height of 420 ft. above a foaming waterway in the midst of a wild district, far removed from any source of supplies. One difficulty after another was encountered, but ultimately there came into being the great steel arch that carries the railway across the gorge so close to the Falls that trains are often delayed by spray. In a sense this bridge may be said to have been built, not at the Zambesi River, but in Darlington; for the contractors (the Cleveland Bridge Co. Ltd.) erected all the members in their yards before sending them out to the site.



The building of Wearmouth Bridge; the arch ribs in course of erection. For this and the other photographs illustrating this article we are indebted to the courtesy of Sir William Arrol and Co. Ltd.

Another great steel arch is shown on the cover of this month's issue, which depicts the bridge that carries the Canadian National Railways over Niagara Gorge, about a mile below the Falls. This bridge has a total length of 780 ft., the length of the main arch being 550 ft. It is a two-deck structure, the upper deck, 225 ft. above the river, carrying a double line of rails, and the lower deck a roadway 25 ft. in width.

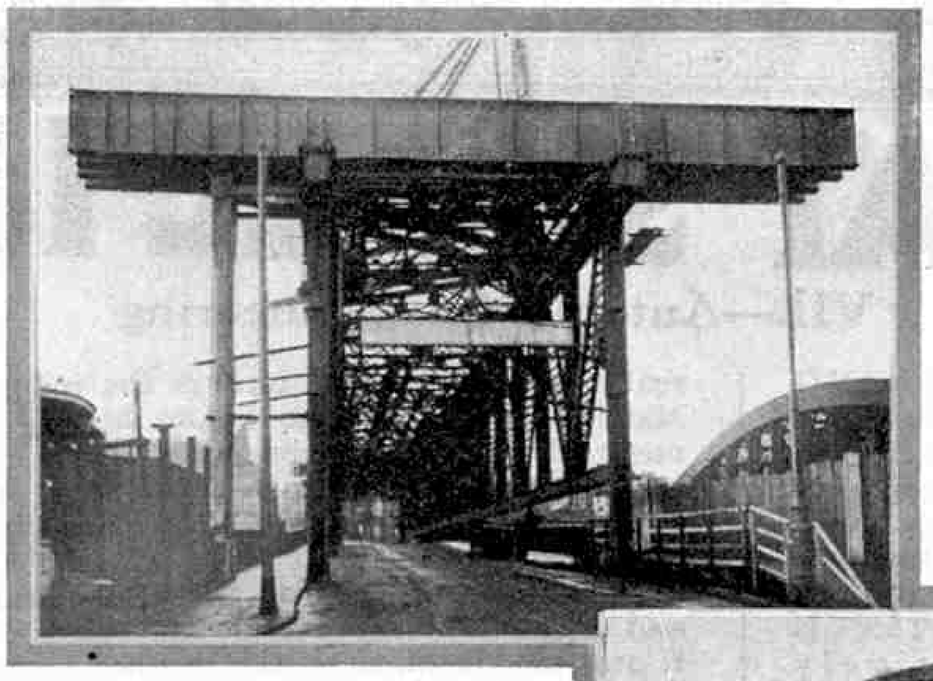
Many instances might be quoted of the erection of steel bridges in situations and circumstances where the use of masonry would have been impracticable. For instance, in the case of a road bridge in Basutoland it was necessary that, once construction had been commenced, it should be completed with the utmost rapidity on account of the sudden floods to which the river was liable. These floods gave little or no warning of their approach, and were of sufficient violence to have carried away any partially completed work. The steel bridge was designed as a riveted structure, and matters were so arranged that, by the insertion of a few bolts and drifts in the joints and connections, the bridge was rapidly made sufficiently secure to withstand the onslaught of the floods.

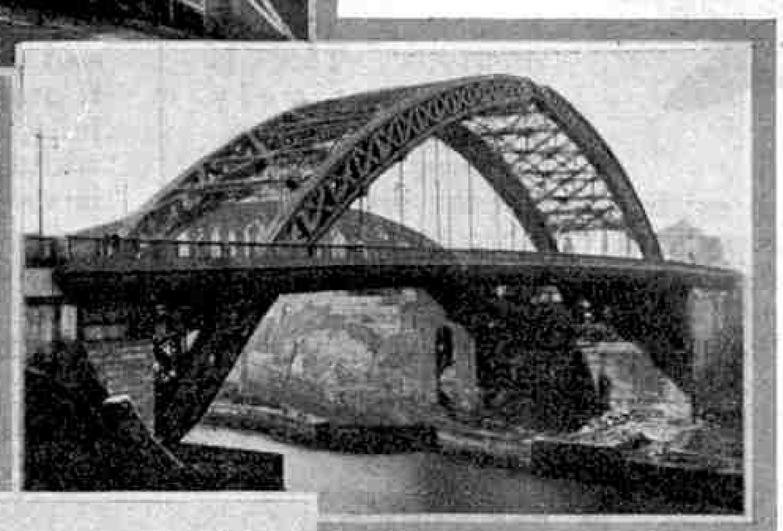
An example of a bridge erected over a river in a city with busy streets at both sides is provided by the new Caledonian Railway Bridge in Glasgow. This bridge consists of three main river spans, the centre one being 200 ft. in width between the piers, while the north and the south spans are 162 ft. and 178 ft. respectively. Over the street on the north side the span is 92 ft. and on the south side 60 ft. The structure is a deck bridge with a width of 118 ft. to 205 ft., and main girders 12 ft. apart centre to centre; and it had to be erected from start to finish without interfering with the navigation of the river.

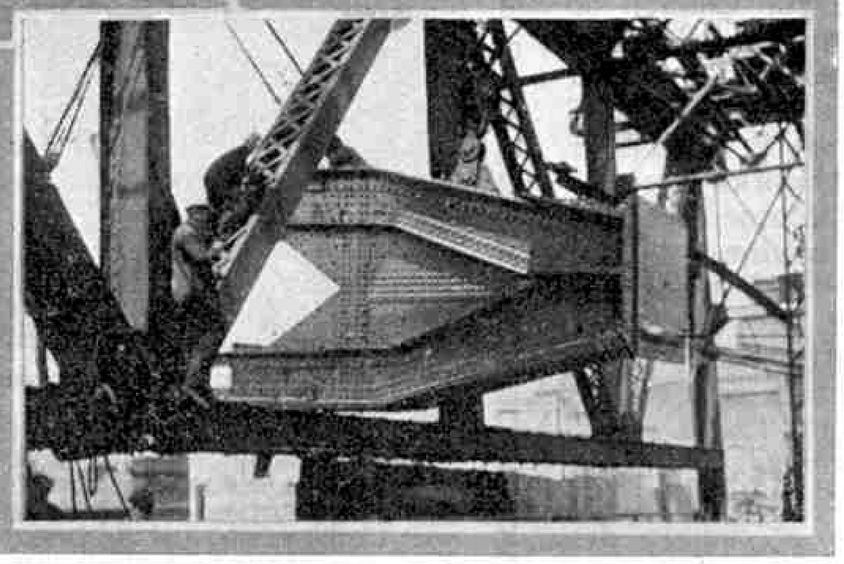
The method adopted in erecting this Clyde bridge was that of building upon specially-prepared stagings. Other river bridges have been erected by building complete spans on land and floating them into position by means of pontoons. Thomas Telford floated out 450 ft. of the suspension chains for his Menai Suspension Bridge, and Robert Stephenson adopted the same method with the tubes of his Britannia Bridge close by.

Still another method of bridge erection is by overhang, in which the permanent structure is dependent upon itself for stability. If its design is such that it is not suitable for cantilevering out, it must be reinforced and have temporary additions made to it. Arched bridges can be erected with great facility by converting them into temporary cantilevers and building them out from both sides, as was done in the case of the new bridge over the Tyne at Newcastle. An interesting example of the erection of an independent girder bridge by overhang is that of the Queen Alexandra Bridge, Sunderland. The three land spans, each of about 200 ft. clear, were erected upon staging, but on account of the necessity of keeping the waterway uninterrupted it was impossible to erect the river span in this manner. In this case the girders were converted temporarily into cantilevers and the span was erected by overhang from each pier. The weight of steelwork in this span, which has a length of 330 ft. clear, is 2,600 tons, and each main girder weighs 960 tons.

Perhaps the best method of illustrating the process of building with steel will be to give a brief description of the construction of a particular bridge. For this purpose we will choose the Wearmouth Bridge at Sunderland, which is an interesting example of the erection of a new bridge on the site of an existing one, and under very severe restrictions. The new bridge had to be erected, and the old one removed, without restricting either the road or the river traffic during the operations. A further difficulty was that the existence of public works on both sides of the river prevented any space outside the area of the bridge being available for plant or for a storeyard.







Wearmouth Bridge. Above—Temporary structure erected over the old bridge; Centre—Two views of the completed bridge; Below—Lowering bottom section of rib into position.

The old bridge consisted of three box-shaped arch ribs of 236½ ft. clear span, with a width of 41 ft. between the parapets. It had been seriously weakened through settlement of the abutments as the result of colliery workings in the neighbourhood, and of the increasing road transport loads it had to bear. The new bridge consists of a three pin arch having a span of 375 ft. centre to centre of the springer bearings; and the ribs are 54½ ft. apart from centre to centre. The roadway is 48 ft. in clear width, with cantilever footpaths outside the ribs, the total width between the parapets being 79 ft.

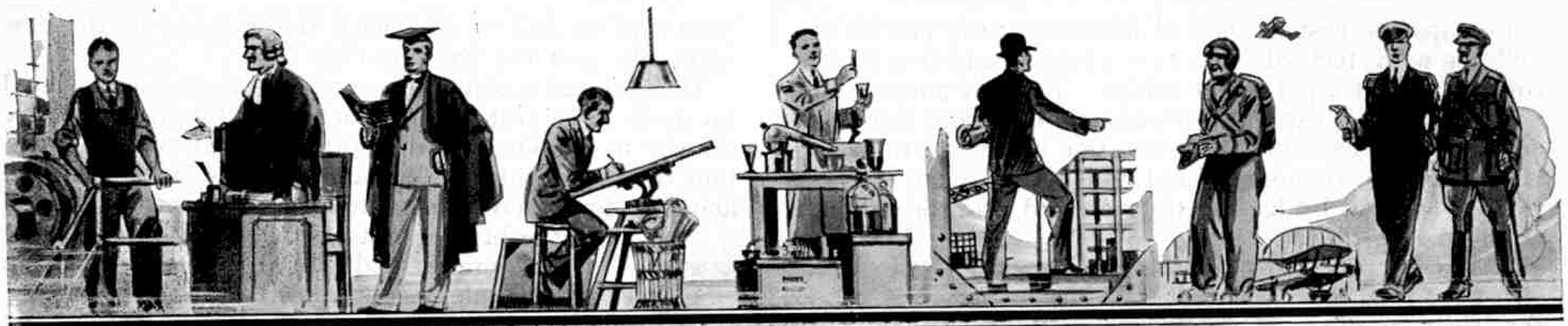
The consulting engineers, Messrs. Mott, Hay and Anderson, left the contractors, Sir William Arrol & Co. Ltd., free to select the method of erection, provided that it complied with the limitations laid down by the Corporation and river authorities. It was decided to erect a temporary bridge in the roadway over the old bridge, and supported on the old abutments at points 260 ft. apart. The distance between the main girders of the temporary bridge was sufficient to allow the existing double-track tramway and the road traffic to pass freely over the old bridge, while the pedestrian traffic occupied the existing footways. The temporary bridge had extensions of 119½ ft. at the north end and 62 ft. at the south end, which served as overhead platforms for cranes and stagings. These extensions were erected on the roadway, with the extreme ends suitably weighted and anchored down to the old masonry.

It was considered unwise to add any further load to the old bridge, and therefore the central 260 ft. of the temporary main girders were cantilevered out until they met in the centre of the span. Two 15-ton electric derrick cranes were then erected on the top of the temporary bridge and mounted on bogies so that they could travel from end to end to deal with the erection of the new main ribs and the wind-bracing.

The material was manufactured in Glasgow and riveted up in as large sections as practicable for transport by railway to Monkwearmouth station, about two miles distant from the bridge. The largest pieces, which weighed about 20 tons, were transported by road from the station to the bridge, and lifted by tackles or by the derrick cranes and placed in position. As a general rule, pieces from Glasgow were in position within 36 hours of leaving the works. The 20-ton pieces forming the lower end of the ribs were beyond the capacity of the derrick cranes and were lifted by tackles from the road wagons, threaded through the main girders of the temporary bridge, and lowered into place on their bearings. The remainder of the ribs were handled by the derrick cranes.

The first two lower panels of the ribs were erected upon timber staging. The next two panels were cantilevered beyond the staging and were supported at their free end by temporary hangers suspended from projecting beams on the temporary bridge. This operation was repeated until the ribs were projecting about 100 ft. horizontally from the springing. At this point the ribs had risen above the top of the temporary bridge. Each half rib was then supported upon a 500-ton hydraulic screw jack that rested upon cross girders passing through the temporary bridge and projecting about 20 ft. beyond the main girders on each side. At this stage the levels of the ribs were adjusted to allow for the further deflection of the temporary bridge and of the ribs during their building by overhang to the crown, a further distance of 82 ft. This length was built by overhang beyond the hydraulic jacks. It was arranged that the ends of the ribs when built to the crown should be a few inches above their correct position to give sufficient room between them for the insertion of the crown bearings, which were clamped together and bolted up to the ends of the ribs on one side. When this was completed the ends of the ribs were lowered to butt on their bearings at the crown by exhausting the 500-ton hydraulic jacks upon which they rested.

On the completion of the arched ribs the hangers from the ribs to the cross girders were (*Continued on page 418*)



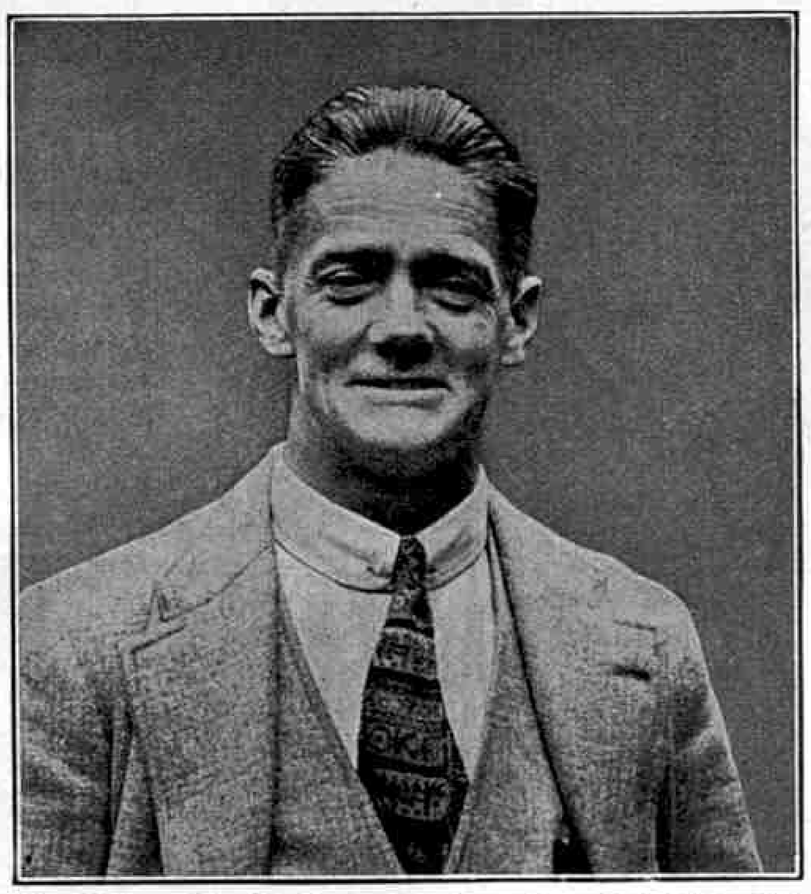
WHAT SHALL I BE ?

VII.—Automobile Engineering

CONTINUING our series of articles on careers in engineering we now come to the automobile branch of the industry. This is comparatively young and is expanding rapidly. In its present form it came into existence with the invention of internal combustion engine. Every year this becomes of greater importance, and it is now being employed not only for road vehicles, but also in aeroplanes, on locomotives, and for the propulsion of sea-going vessels. Its range also has been greatly extended by the introduction of engines using heavy oils of high flash point instead of the more easily inflammable petrol. The engine is the central feature of a motor car or lorry, and to a certain extent, therefore, the scope of this branch of engineering goes further than motor car construction and design, but in the present article we propose to deal only with the prospects in the latter.

It must be remembered that automobile engineering is only a branch of general mechanical engineering. A thorough knowledge of this is essential and should be obtained before specialisation. In this connection it is interesting to note that the Council of the Institution of Automobile Engineers does not consider it essential that apprenticeship to the branch of engineering with which it is concerned should be served in a works devoted to the construction of motor cars and internal combustion engines. Any suitable engineering works are satisfactory for the purpose, provided that in the immediate neighbourhood there are facilities for study in evening or part time day classes. The Council recommend that the last year of apprenticeship should be spent in an approved service or repair department, however, for in this manner special knowledge of this branch of the industry may be obtained.

FAMOUS ENGINEERS—7



Sir William Morris, Bart., founder of Morris Motors Ltd., has had a very romantic career. He received his education at the village school at Cowley, Oxfordshire, and began his business career by repairing bicycles. He became interested in motor cars, and at the close of the War turned his attention to mass production. The firm that he founded now employs over 15,000 people, and the annual turnover of the numerous companies he controls exceeds £20,000,000 !

In previous articles in this series it has been pointed out that undoubtedly the best method of entering the various branches of engineering dealt with is to attend a University or Technical College and to obtain a degree. Practical works experience also is necessary, of course, and this may be obtained by means of apprenticeship before or after the University course, or by pursuing a mixed or "sandwich" course of the kind that has been described in previous articles in this series.

These considerations also apply to automobile engineering, and the Institution of Automobile Engineers advises that the works apprenticeship should be served before a full time course at a University or Technical Institute is taken. Aspirants to really worth-while positions in the industry should obtain their Matriculation Certificate before leaving school and should immediately enter an engineering works. After three years spent in the shops and in study at evening or part time day classes, they should be in the position to make the most of more advanced instruction.

University training has the disadvantage that it is prolonged and somewhat expensive. The outlay and time spent over it are fully justified by the prospects open to those who successfully complete this extended course, but direct apprenticeship without University training appears to provide the more popular mode of entry into the industry.

In most works where motor cars are manufactured apprentices are taken on when they are between the ages of 16 and 20. Usually they are expected to pass an entrance examination or to produce satisfactory evidence of having received education of the requisite standard. As is customary in most branches of engineering there are two classes, known as trade and technical apprentices respectively. Premiums may be required, particularly from those who wish to become technical apprentices, but this is by no means universal and the modern tendency is to do without such payments.

As is the case in other branches of the industry already dealt with, trade apprentices are only trained to become skilled workmen in some branch of automobile engineering. There are exceptions to this rule, for in some of the larger firms they are allowed to pass through many of the shops and so to gain a fairly comprehensive knowledge of the work carried on throughout a factory. The usual term of apprenticeship is five years and during that time the usual small but progressive wage is paid.

The prospects of a technical apprentice are much superior to those of the trade apprentice, for he spends varying periods in most of the departments found in automobile engineering works. In these he gains the necessary knowledge of general engineering by passing through the machine, fitting, and erecting shops. In addition, he acquires more specialised knowledge in the engine and road testing departments and in the drawing office. Experience also may be gained in the examining, rate fixing, tool design and costing departments. This will be of the greatest value to the apprentice who hopes eventually to take up a really responsible position.

It is very important that a technical apprentice should continue his studies throughout the three to five years during which he serves, for otherwise he will be unable to reap the full benefit of his works experience. Practically all Technical Schools of good standing arrange courses of study for the National Certificate in Mechanical Engineering, and it should be his aim to secure this diploma. He should follow it up by taking the National

Higher Certificate, paying special attention to the branch of engineering in which he is specialising.

Apprentices in this industry will find membership of one of the Junior grades of the Institution of Automobile Engineers invaluable during their period of training. On joining this body they may take part in meetings arranged for their benefit, at which they may join in discussions or read papers, and thus develop powers of expression that later will be very valuable. They also are entitled to attend regular meetings of the Institution. There they come into contact with their seniors, and hear accounts of the latest developments from eminent engineers who are responsible for them. Visits to works in which cars, accessories and special materials are manufactured also are arranged. These give splendid opportunities of seeing methods of manufacture and works layouts of many different types. Full information in regard to the privileges and advantages of membership of the Institution may be obtained from the Secretary, Watergate House, Adelphi, London, W.C.2.

Reamering and crank fitting machine in the repair shop of the London General Omnibus Co.'s works at Chiswick.

The boy who possesses a natural aptitude for automobile engineering and is anxious to enter the industry should seriously consider the prospects before taking definite steps. If he is not afraid of hard work or study, and is prepared to work his way upward from the bottom of the ladder, he should begin by looking round for a suitable place at which to undergo the necessary training.

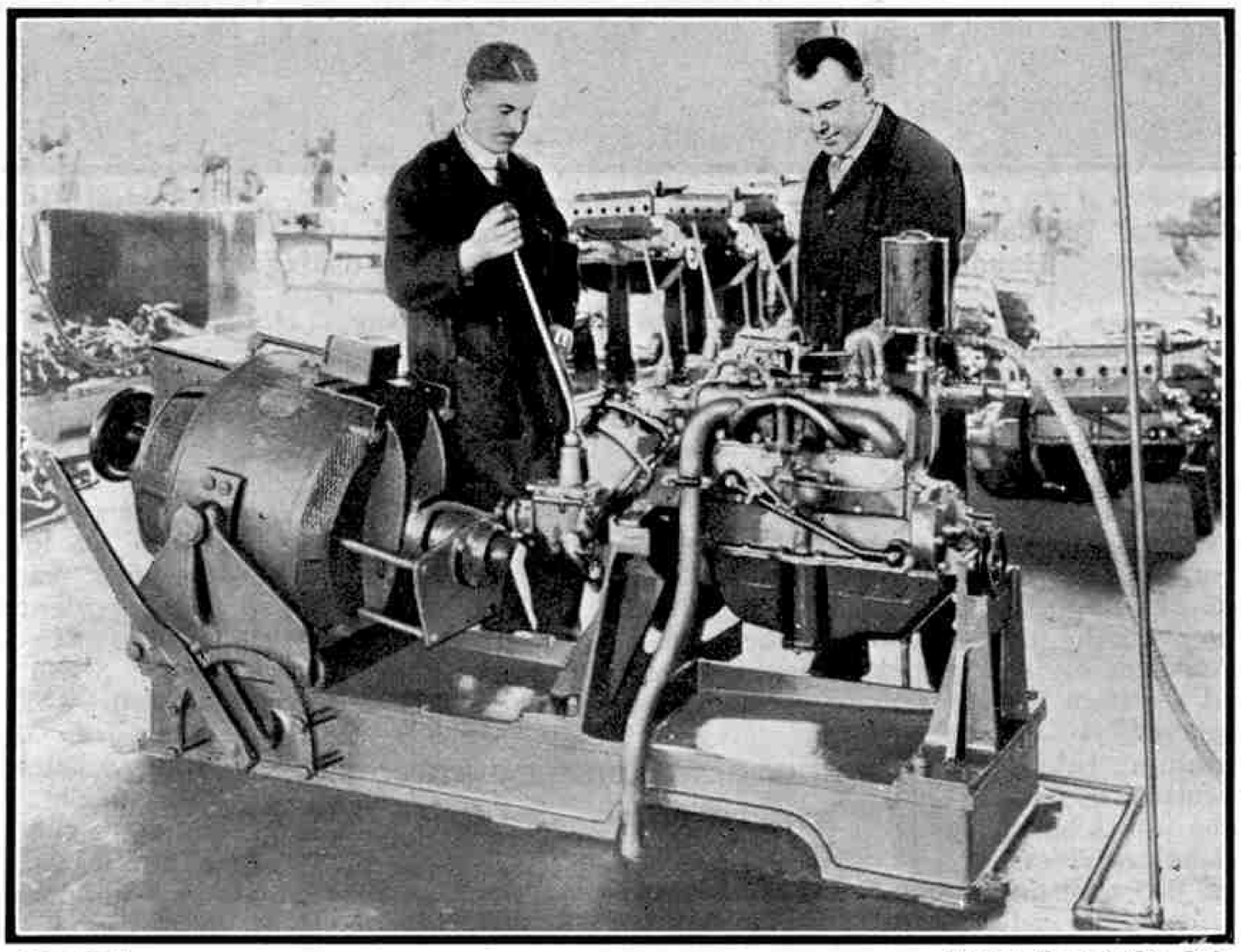
Enquiries regarding apprenticeship may be made from local firms of repute, but the list of firms whose training systems are approved by the Institution of Automobile Engineers also should be studied. This may be obtained from the Secretary of the Institution, and the Editor of the "*M.M.*" also will be pleased to give information.

After careful study of the details available the would-be apprentice should write to several of the firms whose conditions appear to meet his special requirements, and make his final selection after careful comparison of the advantages offered. It may be found that certain firms have no vacancies and in that case application should be made to others that may appear suitable.

When the articles of apprenticeship have been signed the future engineer may then settle down to a course of hard work and study. If he displays exceptional ability and aptitude he will be given every encouragement, and at the end of his apprenticeship he may be given a position in the works in which he has been trained. It must be clearly understood that no firm definitely undertakes to provide employment for apprentices who have completed their periods of service, but in practically all cases there would be a reluctance to allow a really good man to leave.

In any case, at the completion of the apprenticeship term a fully trained automobile engineer should look round for suitable opportunities, either of gaining further experience in some branch of his work, or of making a good position for himself. The motor car industry is still expanding and in it there are numerous opportunities for eager and energetic men. The greatest success comes to those who are prepared to branch out and not to remain working engineers employed in the shops throughout their lifetime. A knowledge of commerce may be found very useful, for an engineer who is familiar with this intricate subject is qualified for more responsible positions on the administrative side of the industry or in the sales departments.

There also are many valuable openings for the men who remain engineers only. For instance, a young man who is interested in the scientific aspect of his work may find his way into the works laboratory, in which materials are tested before being used, or into the experimental and research department, where new work is planned and inventions and novel designs are tried out. Another branch that offers scope for a well informed and energetic engineer is the service department.



Courtesy] [*Henry Ford & Son Ltd.*

Running-in engines at the Ford Motor Works. Electric motors are used to drive engines at high speed.

Even these do not exhaust the prospects of a fully trained motor engineer, for he may leave the manufacturing side of the industry and take up equally responsible and well remunerated posts outside. Motor transport seems destined to attain enormous proportions. Already our roads are becoming crowded with motor omnibuses and giant lorries, and the next few years undoubtedly will see an enormous increase in traffic of this description. The companies that own and run public service vehicles require a competent technical staff in order to advise them on the purchase of new vehicles and to superintend the overhauling and repair of those already running. Many good openings of this character are available, and similar positions also may be found in the transport departments of large industrial firms, most of which now maintain fleets of motor vehicles.

Another direction in which good posts may be found is insurance. In dealing with many claims that are made, large companies insuring motor vehicles require expert advice, and a thoroughly experienced motor engineer in their employ may command a good salary.

The Westland "Wapiti"

The Westland "Wapiti" is a "General Purpose" two-seater aeroplane, its duties including bombing, reconnaissance, photography, wireless, long-range desert patrol, and advanced training. In order to enable it to fill such a range of requirements the machine possesses a good speed, excellent manœuvrability, extremely robust construction, and is comfortable and light to handle. In addition it is designed to reduce to a minimum the work of maintenance.

The "Wapiti" has a wing span of 46 ft. 5 in., and a length of 32 ft. 6 in. Its weight loaded is 4,856 lb. It is fitted with Handley-Page automatic wing slots. Frise type ailerons are employed. These render the machine particularly light on the lateral controls, and a large well balanced rudder gives excellent directional control.

The undercarriage is of the Westland Oleo-leg type which has proved extremely satisfactory in service and has the advantage of needing very little attention. This land type undercarriage may be replaced by floats, thus converting the machine into a seaplane.

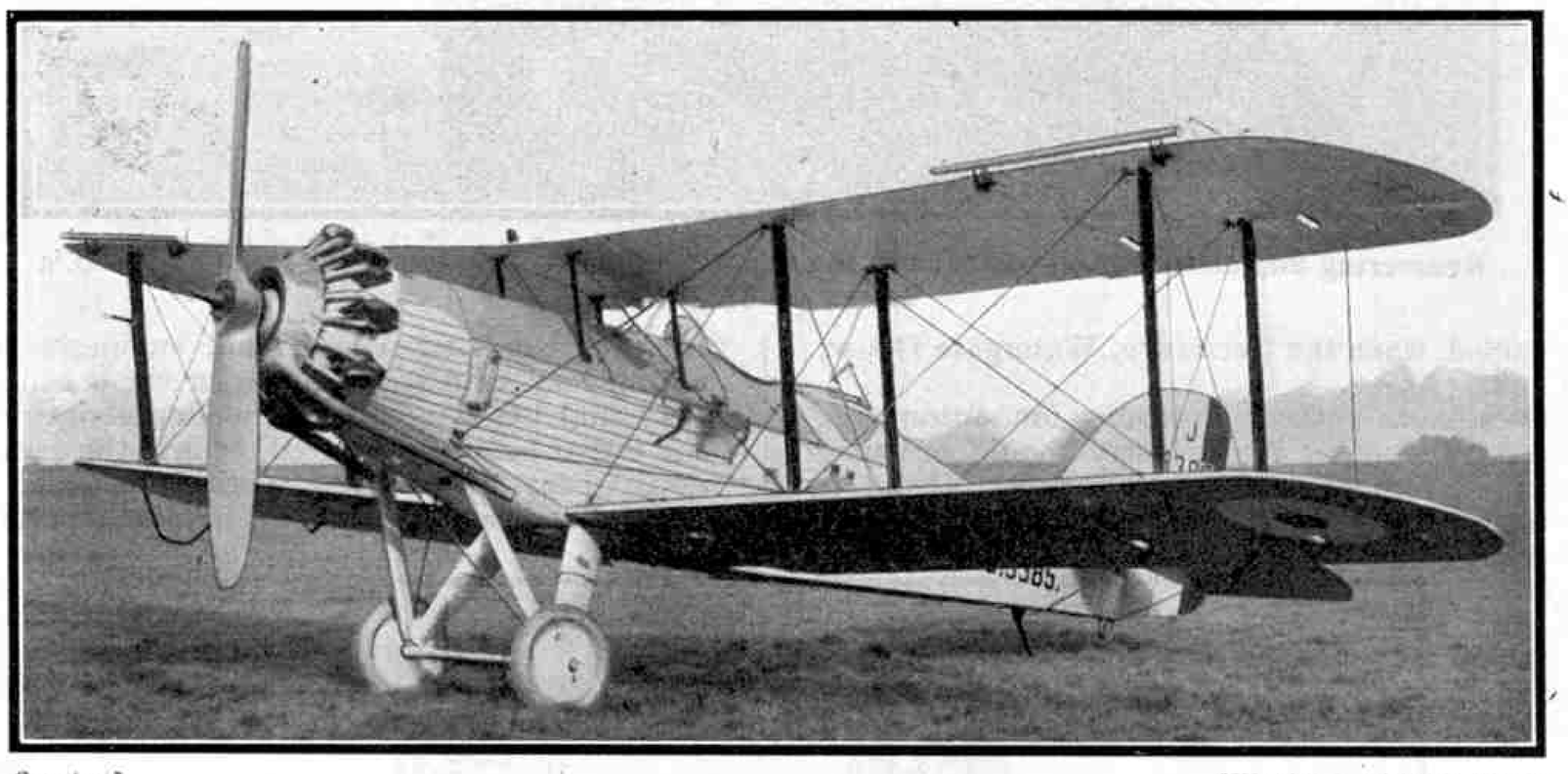
The "Wapiti" can be supplied as an "all-metal" machine or one of composite wood and metal construction. In the all-metal type, shown in the accompanying illustration, the Westland system of metal construction is displayed to advantage. Steel and duralumin tubing of approximately square section is used for the fuselage members, the joints being made by flat fish plates and hollow rivets.

The struts are not made to bed together accurately, but a small clearance is allowed, the loads being taken by the hollow rivets. This form of construction lends itself to rapid production, great strength and rigidity with minimum weight, and the easy replacement of parts.

A single radial air-cooled engine is fitted, this type being specifically chosen in view of the various climates and wide range of temperatures in which general purpose aircraft are called upon to operate. The engine employed may be either a "Bristol" Jupiter VI, a Jupiter VIII, or an Armstrong Siddeley "Jaguar."

The armament carried consists of a Vickers .303 gun firing forward through the airscrew, and a Lewis gun mounted on a Scarff gun ring on the observer's cockpit. Firing steps are fitted to enable the gunner to fire vertically downwards, and for bomb sighting he can assume the prone position, a sighting aperture being provided in the bottom of the fuselage.

When fitted with a Jupiter VIII engine, the "Wapiti" has a top speed of 142 m.p.h. and will climb to 10,000 ft. in 11 minutes. The service ceiling is 24,000 ft.



Courtesy [*Westland Aircraft Works*

The all-metal Westland "Wapiti" general purposes machine. On the upper wing the open Handley-Page automatic slots may clearly be distinguished.

"*R100*" Not to be Flown in the Tropics

According to the Under-Secretary for Air, the British airship "*R100*" is not regarded as suitable for use in tropical climates because she is equipped with petrol engines, and for this reason her sphere of operations will be restricted to the northern latitudes. The sister ship "*R101*" is fitted with compression ignition engines, in which fuel with a higher flash-point is used. As yet these engines are in the experimental stage, however, and it is not proposed to install them in "*R100*" until definite proofs of their efficiency are obtained.

THIS MONTH'S AIR STORY

Pilot (to lady inspecting his aeroplane): "And this, madam, is the engine."

Lady: "But if it's fastened like that, how can it turn over?"

Aeroplane Rescue in Switzerland

An aeroplane played a remarkable part in the rescue of four ski-runners who recently were lost in the Churfirsten mountains in Switzerland. When news of the skiers' disappearance reached Zürich, a message was despatched to the military aerodrome at Dubendorf, and an officer was deputed to make a search.

The airman flew in the direction of the place in which the skiers had last been seen and discovered their whereabouts in less than 30 minutes. He dropped a supply of food and blankets to them, and then flew to Unterwassen in order to give the patrol stationed there the information necessary to enable them to effect a rescue. The success of the search by air has led to a promise by the authorities that military aircraft always will be available in emergencies of this kind. This decision is of great importance, for in mountainous regions the aeroplane provides the only means by which a large area may be thoroughly searched in a comparatively short time.

This is not the only instance in which an aeroplane has been the means of rescue of lost or disabled climbers. In the first case on record the discovery was accidental and not the result of a search. It occurred in the summer of 1928, when two men were seriously injured while negotiating one of the spurs of Mont Blanc. An aeroplane taking visitors for flights over the mountain peaks passed overhead, and fortunately the pilot saw the frantic signals of the injured climbers, who were waving their handkerchiefs and alpenstocks. He immediately flew back to the aerodrome at Chamonix. There he landed and in red letters painted on the underside of the wings of his machine a message warning the climbers to remain where they were. After returning to the injured couple, and circling over their heads in order to enable them to read his message, he flew to Montenvert, from which place he guided a rescue party who eventually rescued the mountaineers, both of whom were in a serious condition.

British Empire's Greatest Air Beacon

Promptly at 9 p.m. on 3rd March, 1930, the great Canadian air beacon shown in the illustration on this page was illuminated for the first time. It is situated upon the roof of the Hudson's Bay Company's store in Winnipeg, Manitoba, and the lighting up of the 48 neon tubes on the tower coincided with the opening flight of the air mail service that has been established between Winnipeg, Calgary, Edmonton and Saskatoon by Western Canada Airways Limited.

The tower of the Winnipeg beacon is 60 ft. in height and its top is 220 ft. above ground. The total weight of the structure is more than four tons.

The illumination is provided by 48 neon light tubes, each of which is 10 ft. in length. They are arranged in two vertical groups and may be seen quite easily from a distance of more than 100 miles. Two pilots have reported seeing the orange glow when they were 122 miles from Winnipeg. On this basis the amount of territory from which the light will be visible is 47,000 square miles in area, and on very clear nights it is believed that the beacon will be visible from a distance of no less than 150 miles.

The directing light at the top of the beacon is of 2,000,000 candle power. It is not intended for distant visibility, but shows pilots the direction they should take in order to reach Stevenson Field, an aerodrome three miles away. The beacon and the directing light will be lit from sunset to sunrise nightly.

British Progress in Gliding

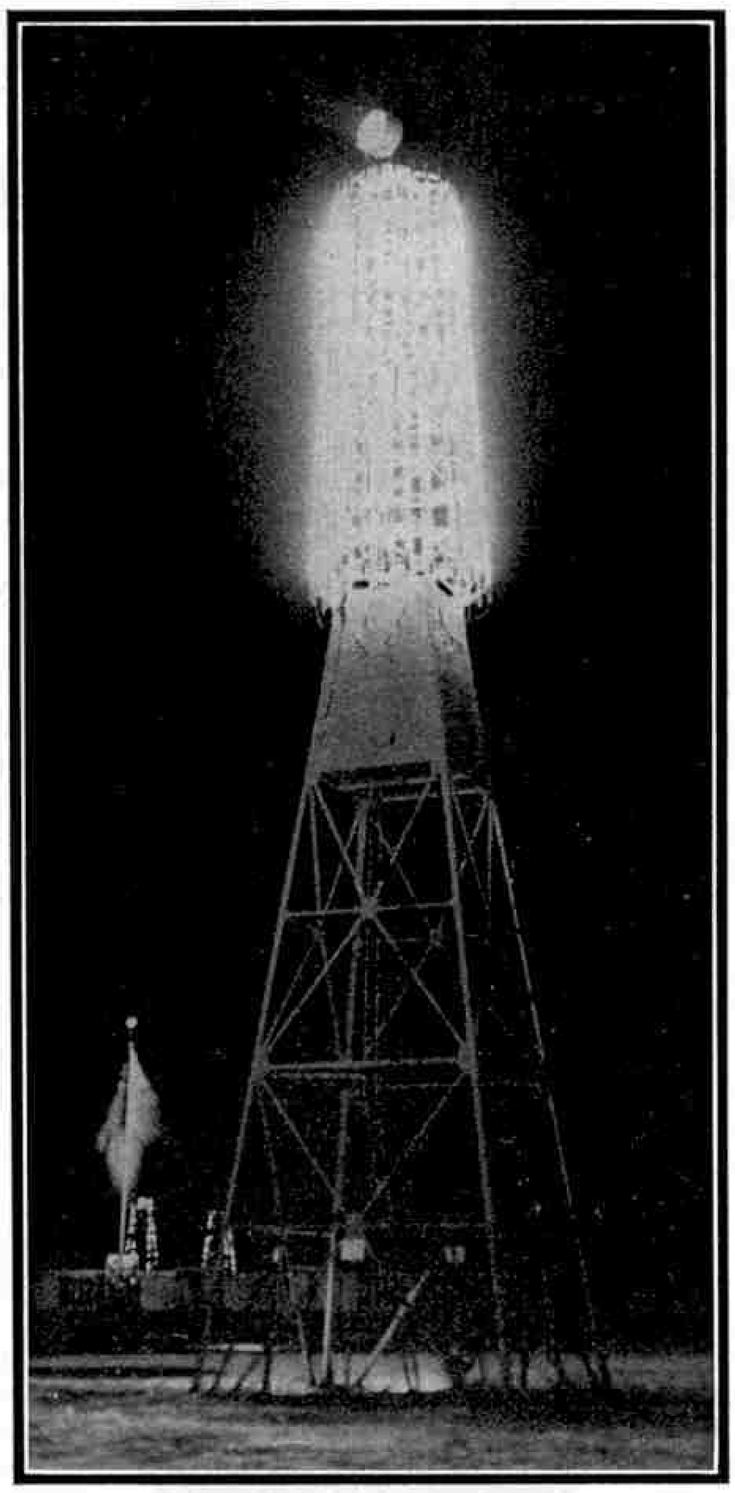
In recent months the new sport of gliding through the air on engineless planes has made great progress in Great Britain. Gliding clubs have been formed in various parts of the country, but as yet activities have for the most part been confined to the construction of machines and to lectures and discussions. The Kent Gliding Club already has designed and built a glider, however, and this has been flown with success. A public exhibition given by the club attracted a very large crowd of onlookers, who were greatly interested in the new form of flight.

In order to regularise the position an organisation called the British Gliding Association has been formed, with Air Vice-Marshal Sir W. Sefton Brancker, K.C.B., A.F.C., Director of Civil Aviation, as President. One of the purposes of this body is to frame regulations for the granting of Gliding Certificates and, in conjunction with a special committee of the Aero Club, the Association has approved regulations set up by the Fédération Aéronautique Internationale.

Three Certificates or Licenses are awarded. In order to qualify for the first, which is known as Certificate A, a candidate must make a flight of 30 seconds duration and this must be followed by a normal landing. The second, or B Certificate, is only given to possessors of the first Certificate who have made two further flights, each of which lasts 45 seconds. During the actual test that must be undergone by each candidate it is necessary to remain in the air for one minute and to make during the flight two S-shaped curves.

The third Certificate, or License C, is only given to fully qualified gliders. It is much more difficult to obtain than the others, for a flight of no less than five minutes' duration must be made at an altitude greater than that of the spot from which the flight is commenced.

A prize of £1,000 has been offered to the British Gliding Association for award to the first British pilot who crosses the English Channel between 1st June, 1930, and 31st May, 1932. The flight must be made in a British glider. It is interesting to record that a prize of £50 offered in 1922 for a glide of 50 miles in a straight line is yet unclaimed.



The great air beacon erected on the roof of the Hudson's Bay Company's store in Winnipeg. On the tower there are 48 neon tubes each 10 ft. in length, and the glow is visible from a distance of 120 miles.

Air Mail Services at Croydon

It is expected that during the coming summer a record number of air mail services will arrive at and leave Croydon Aerodrome. Every day Imperial Airways Ltd. and the K.L.M., a well-known Dutch company, will run ten services each, five outward and five inward, while the Air Union and Sabena will have nine services between them. The usual Luft Hansa services also will be in operation and it is expected that by summer the Czecho-Slovakia Air Lines will have inaugurated a new service between London and Prague.

British Machines for Foreign Powers

A striking proof has been given of the increasing popularity of British aircraft among foreign powers. Some months ago the Latvian Government took delivery from the Bristol Aeroplane Co. Ltd., of five "Bristol" Bulldog all-steel single-seater fighters fitted with Jupiter Series VI engines. The authorities have been so delighted with the service and high performance obtained with these machines, that an order has been placed with the Bristol Company for seven additional Bulldog machines. Five of these will be fitted with direct drive Jupiter engines and two with supercharged Jupiters.

An order for 12 aeroplanes of this type also has been received from the Government of the neighbouring country of Estonia. Before deciding to adopt a new type of aircraft the authorities awaited the results obtained in Latvia with the "Bristol" Bulldog machines. These were so convincing that, in spite of keen competition from other quarters, the "Bristol" Bulldog was adopted as the new single-seater fighter for the Estonia Air Force.

The speed of the "Bristol" Bulldog is 148 m.p.h. at ground level and 156 m.p.h. at a height of 5,000 ft. The first 5,000 ft. climb is completed in 2·9 mins., while the service ceiling, 29,200 ft., is reached in 31 mins. The absolute ceiling is 30,300 ft.

New Canadian Air Mail Services

Daily air mail services across the prairies between Winnipeg, Calgary and Edmonton have now been inaugurated. The aeroplanes operating the service leave Winnipeg at 9 o'clock every evening and perform the 770 mile journey during the night, arriving at Calgary at 5 a.m. On the eastbound journey the machines leave Calgary at 2.15 a.m., reaching Winnipeg at 12.15 in the afternoon.

The service between Regina and Edmonton, a distance of 456 miles, is performed by an aeroplane leaving Regina at 8 a.m. and arriving at Edmonton at 1.50 p.m., the return journey being operated by a machine that leaves Edmonton at 12.15 in the afternoon and arrives at Regina at 6 p.m.

New Supermarine Air Yacht

The first flying boat to be constructed in England for a private owner has been built by the Supermarine branch of Vickers (Aviation) Ltd. The boat is an all-metal triple-engined monoplane, and is the first of the type to be constructed at the Supermarine works. The owner, the Hon. A. E. Guinness, ordered the boat to replace a Supermarine "Solent" machine previously used, and he intends to employ the new machine for cruising between England and Ireland.

In appearance the hull of the air yacht is similar to that of the giant flying boat, the Dornier "*DO.X.*," that was described on page 922 of the "*M.M.*" for December, 1929, but of course, it is much smaller. It has straight sides, and its resemblance to the German boat is increased by the fitting of short stabilisers midway along the hull and slightly above the water line of the boat. In addition to giving stability to the machine, these projections contain the emergency fuel supply and may be used as "platforms" when passengers are arriving at, or leaving, the boat.

The yacht has accommodation for a total of nine people, including the crew of three, and is fitted with dual control. Four open cockpits are provided in addition to well equipped sleeping quarters. Electric lighting is installed and the vessel also carries a wireless receiving and transmitting outfit.

The three engines with which the vessel is equipped are Armstrong Siddeley "Jaguars" fitted with Townend rings. The normal cruising speed is 100 m.p.h., but for short periods 120 m.p.h. may be attained. The range of the fully loaded machine is 650 miles. Its all-up weight is 23,520 lb., and with a full complement of passengers and crew a maximum of 600 lb. of luggage may be carried.

XVI.—THE ELECTRIC INCANDESCENT LAMP

THE electric light that plays such an enormous part in the life of the world to-day has been brought to its present perfection by the combined efforts of many scientists and inventors extending over a period of some 130 years. In 1801 Sir Humphry Davy, one of the greatest of English scientists, was appointed lecturer on chemistry to the Royal Institution, London. Davy was always a keen and tireless experimenter, and in his new sphere he found fresh facilities for research. In order to provide him with an adequate source of electric current the Institution placed at his disposal a large voltaic battery consisting of 2,000 cells. Shortly afterward Davy discovered that if two rods of carbon, one connected to each terminal of his battery, were brought into contact and then gradually separated, an arch of light was produced between them.

This electric arch, or arc as it came to be named, was of dazzling brilliance, and at once suggested the possibility of using it as a source of illumination. Unfortunately such a course was out of the question at that time. The only source of current was the voltaic cell, and the cost of setting up and maintaining a battery of sufficient size was so great as to make the idea economically impossible. The electric arc therefore remained little more than a cientific curiosity until the dynamo became a practical and reliable source of electric current producible at a cost that was commercially practicable.

The manner in which the arc is produced is very interesting. Before the two carbon rods are brought into contact the resistance of the air space between them is too great to allow a spark to leap across; but as soon as the rods touch a current passes. When the rods are afterwards slightly separated the spark produced volatilises a small quantity of carbon between the rods, and the carbon vapour forms a sort of bridge across which the current is able to pass. The vapour has a very high resistance, however, and becomes intensely heated by the passage of the current; while at the same time the tips of the carbon rods become hot and glow brilliantly. When the rods are placed horizontally the incandescent carbon vapour is carried upward by rising currents of heated air, and thus assumes the typical arched form. If the carbons are vertically over one another, however, the vapour forms a more or less straight line instead of an arch.

When the carbon rods are fully exposed to the air they waste away slowly by oxidisation. If the arc is produced by direct current, such as that from Davy's great battery, minute particles of carbon are torn off from the positive rod and carried across to the negative rod, with the result that the former consumes away at about twice the rate of the latter. The end of the positive rod assumes the form of a little cup or crater, while the negative rod is pointed. If alternating current is used, however, both carbons are consumed at the same rate, for each in turn automatically becomes the positive electrode.

It was found that this wasting away of the carbons could be greatly reduced by enclosing them in a glass globe. In this case, when the current was switched on and the arc formed, the oxygen inside the globe was quickly consumed and, as the globe was not airtight, the heated gases produced inside it prevented the entrance of further supplies of fresh air. When the lamp was extinguished and the carbons cooled down, fresh air entered once more.

Although by enclosing them in the manner just described the carbons could be made to last much longer, they still gradually consumed away, and eventually the distance between them reached a point at which the arc broke and consequently the light ceased. In order to prevent this it was necessary to provide some means of pushing the carbons together at such a rate as to compensate for the wastage. In the earliest arc lamps this had to be done by hand, but subsequently various mechanisms were devised by which the distance between the carbons was automatically maintained. One simple mechanism for this purpose operates by means of solenoids, that is coils of wire which, when a current passes through them, acquire the properties of an electro-magnet and have the power of drawing into their interior a core of soft iron.

Sir Joseph Wilson Swan, F.R.S.

The diagram on the opposite page shows how the mechanism operates. P is the positive carbon rod and N the negative. H, the holder for the positive rod, is connected to a rod of soft iron, C, which is wound with two separate coils of wire, of which A has a low resistance and B a high one. Each of these coils is a solenoid and C is a core that is common to both of them. Until the current is switched on, the combined weight of H and C is sufficient to keep the positive carbon rod P in contact with the negative rod N.

When the current is switched on it flows along the connecting cable to the point D where it finds two separate paths available—one through coil A to the positive carbon, and the other through coil B and so back to the source of supply. Of these alternative paths the current chooses the one having the lower resistance, which is by way of coil A. Thus most of the current passes through A, but a small quantity goes by way of coil B. As current is now passing through them, both coils are magnetised, and A tries to draw the iron core C upward while B tries to pull it downward. The contest is unequal, however, because coil A, having a much larger current passing through it, has greater power than B, and therefore succeeds in pulling C upward. The result is that the holder H is also raised, and consequently the carbons are separated and the arc is struck.

By degrees, as the carbons consume away, the distance between them increases. The current that passes through coil A, proceeds by way of the positive carbon P and the arc to the negative carbon N, and as the distance between P and N increases, the resistance encountered by the current becomes greater. After a time a point is reached at which the path through coil B becomes easier than that through coil A. Gradually more and more current takes the easier path, and presently B becomes the more powerful of the two coils and pulls down the rod C. In this manner carbon P is lowered and brought down towards carbon N. As the gap between the carbons decreases, so does the resistance of the path through coil A; and presently this coil again receives more current than coil B, reasserts its superior strength and, by overcoming the pull of B, checks the further approach of the carbons. In this manner, by the variations in the strength of the two opposing coils, the distance between the carbons is always kept within safe iimits, and therefore there is no interruption of the arc.

The arc lamp was given its first really practical test in the South Foreland lighthouse. The suggestion to install an arc light there was made by the great scientist Michael Faraday, who at that time was scientific adviser to the Trinity House Brethren, the authority responsible for coastal lights. The experiment was

very successful, and the light was so powerful that on a clear night it could be seen from the French lighthouses across the Channel.

Subsequently the arc lamp was brought to a high pitch of perfection, and by reason of its intense brilliance it became very widely adopted for the illumination of open spaces, streets, the interiors of large halls, stations, etc. It also provided the best means of illuminating the exteriors of large shops, theatres, and music halls. In spite of all improvements, however, it remained unsuitable for domestic use; and various inventors began to turn their attention to producing a lamp that would fill the requirements of houses and small interiors in general.

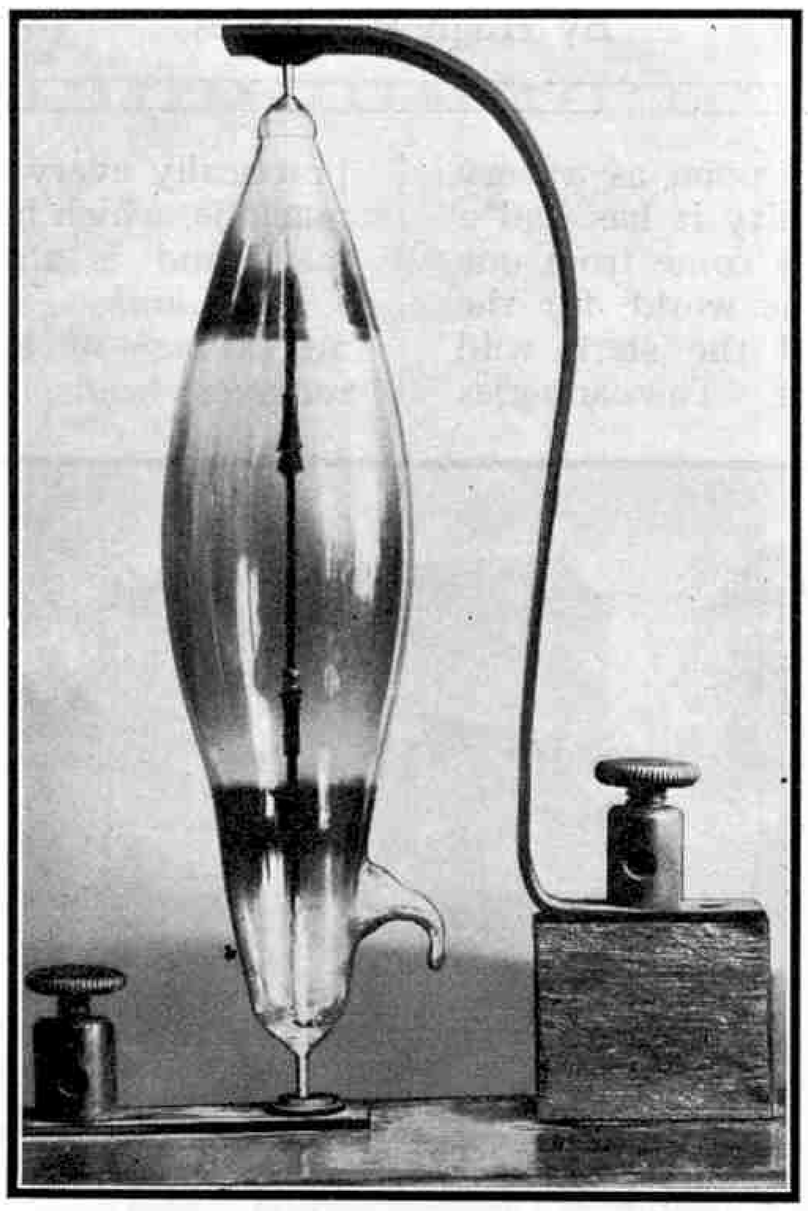
The first man to obtain a patent for an electric lamp of a type other than an arc lamp was an American named J. W. Starr. This patent, which was taken out in 1845, was for an "incandescent" electric lamp that consisted of a short, thin rod of carbon enclosed in a vacuum at the head of a column of mercury. This lamp gave a bright light, but very quickly failed owing to the inner surface of the glass globe becoming black through the deposition of volatilised carbon particles. Several of Starr's lamps were exhibited in London where they attracted a good deal of attention as a scientific curiosity, but they were not regarded as of practical importance.

A description of Starr's lamp came to the notice of a Sunderland youth named Joseph Wilson Swan, who at that time was apprenticed to a local firm of druggists. Swan was keenly ambitious and he acquired scientific knowledge from every possible source. One evening he attended a lecture in the course of which a demonstration was given of the heating to incandescence, by means of an electric current, of a thin wire made of platinum and iridium. Swan was much struck with the brilliant light emitted by the heated wire. He gave the matter a great deal of thought, and finally came to the conclusion that it should be possible to confine a short length of wire in a glass receptacle, arrange for it to be heated to incandescence by an electric current, and in that way produce an electric lamp that would be of greater brilliance and longer life than the one patented by Starr.

The apprenticeship with the firm of druggists ended prematurely owing to the death of the partners, and Swan, then 18 years of age, went to Newcastle where he became assistant to a chemist named Mawson. This man took a strong liking to his keen and enthusiastic assistant, who was always bringing forward new ideas; and being of a generous nature he gave the youth many opportunities of carrying out scientific experiments. The research work carried out by Swan at this time led to his important inventions in connection with photography, with which we hope to deal later in these articles on famous inventions.

Although his attention was very largely devoted to photographic problems, Swan did not forget his earlier ideas for the production of a practicable electric lamp. He realised that the main weakness of Starr's lamp lay in the carbon filament, and he commenced a series of experiments with the object of finding a carbon substitute that could be made of wire-like thinness. His chief materials were paper and cardboard cut into strips, some of which he coiled into spirals. The strips and spirals were placed in powdered charcoal contained in a fire-clay vessel, and this was placed in a small pottery kiln and its contents heated to a very high temperature. At the conclusion of this baking the carbonised strips and spirals were removed from the fire-clay vessel and suspended in improvised glass bulbs. Each one was secured in position in its glass receptacle by wires that passed outward through an indiarubber stopper fitted into the neck of the bulb. As much air as possible was then extracted from the bulb by means of a pump; the wires projecting from the stopper were connected to a battery, and the filament became heated sufficiently to glow brilliantly. This initial success greatly encouraged Swan.

On one occasion during 1860 Swan succeeded in raising to red heat a carbon strip $\frac{1}{4}$ in. in width, and shaped in the form of an arch $1\frac{1}{2}$ in. in height. This arch was suspended, as already described, in a glass vessel from which most of the air had been removed, and was heated by an electric current from a battery of 50 cells. Although the success of this experiment was limited, the result was considered sufficiently satisfactory to prove that, with a more perfect vacuum in the bulb and a more adequate supply of current, a brilliant light could be obtained.



One of the Incandescent Electric Lamps used by Swan in lectures shortly after his invention of the Lamp in 1879.

The difficulty of obtaining a sufficiently perfect vacuum hindered progress for a while, but this trouble was overcome by the invention of the Sprengel mercury vacuum pump. This pump was adopted by the famous scientist, William—afterwards Sir William—Crookes, in order to obtain the very high degree of vacuum required in connection with a radiometer that he had invented. Subsequently Crookes published a report of his experiments with the new pump, and when Swan read this, some time during 1877, he realised that here was the solution of one of his main problems. He promptly determined to resume his electric lamp experiments, and he secured the co-operation of a Birkenhead man named Charles Stearn, who had carried out some very successful experiments with high vacua.

Research was begun at the point where Swan had left off in 1860, and by means of the Sprengel pump improved results were immediately obtained. Difficulty was experienced, however, in keeping the carbonised strip or spiral in a fixed position so as to secure firm contact between it and the leading-in wires; and this led Stearn to experiment with other kinds of carbon conductors. Rods of carbon were reduced to the thinness of wire and were tried both in straight lengths and bent in the form of an arch. The connecting wires were secured in platinum sockets fitted in the necks of the glass bulbs. Experimental lamps made in this manner gave quite a good light, but their brilliance, like that of the lamps of Starr, lasted only for a brief period before becoming dimmed.

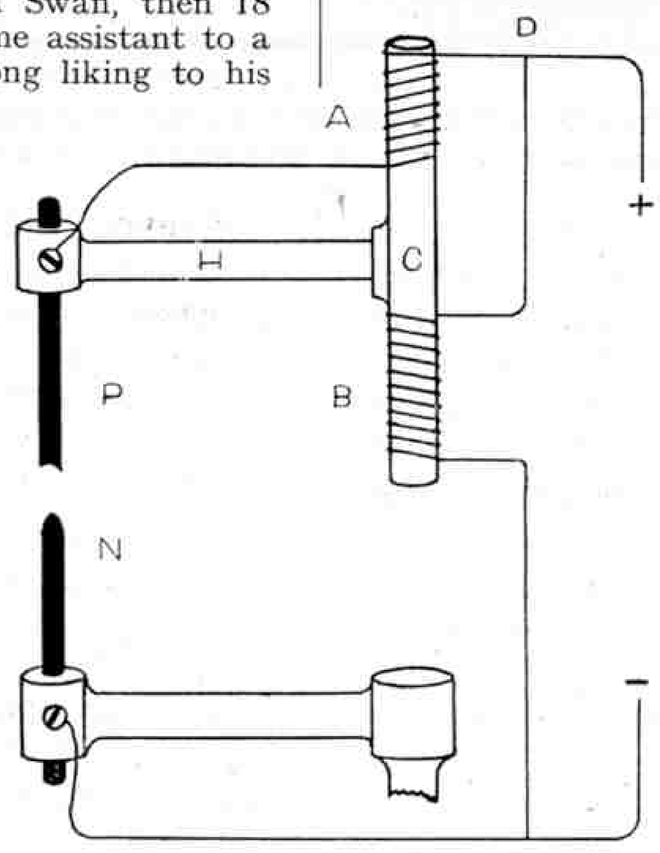


Diagram showing simple method of carbon regulation for Arc Lamps.

Consideration showed that this loss of brilliance was due to deposition of particles driven off from the carbon during incandescence. After further research this trouble was remedied by first exhausting the bulb with the carbon in a cold state and then switching on a current of sufficient strength to heat the carbon to incandescence, while continuing to operate the pump. Lamps exhausted by this process gave an excellent light that did not diminish in brilliance, and Swan realised that at last success was achieved.

In December 1878 Swan exhibited his incandescent lamp at a meeting of the Newcastle-upon-Tyne Chemical Society. This lamp consisted of a cigar-shaped sealed glass tube that had been thoroughly exhausted in the manner just described, and through which extended longitudinally a carbon wire 1/25 in. in diameter. The interest aroused by this lamp was so great that Swan had to repeat his lecture upon several occasions. An interesting account of the demonstration of the invention at one of these lectures is given in the biography, *"Sir Joseph Wilson Swan, F.R.S.,"* by "M.E.S." and "K.R.S.," to which we are indebted for much of the information contained in this article. The book records that Swan concluded his lecture by giving "the signal for the 70 gas jets which lighted the room to be turned out, and then (with a suddenness which in those days seemed quite magical) transformed darkness into light by switching on 20 of his own lamps, producing an illumination which, as compared with gas light, had a very brilliant effect." This was the first occasion (*Continued on page 363*)

Romance of the Salmon Cannery

The "*Iron Chink*" That Does the Work of 60 Men

By Hugh P. Vowles

A TIN of salmon is usually looked upon as a very commonplace object, but in reality it has had a very interesting history. It has come from one of the most remarkable regions of the world, for the canning industry is carried on amid the stern wild scenery of Alaska and British Columbia. The canneries are built on the deeply indented coasts of the Pacific shores of North America, and from practically all of them may be obtained wonderful panoramic views of distant snow-clad mountain peaks.

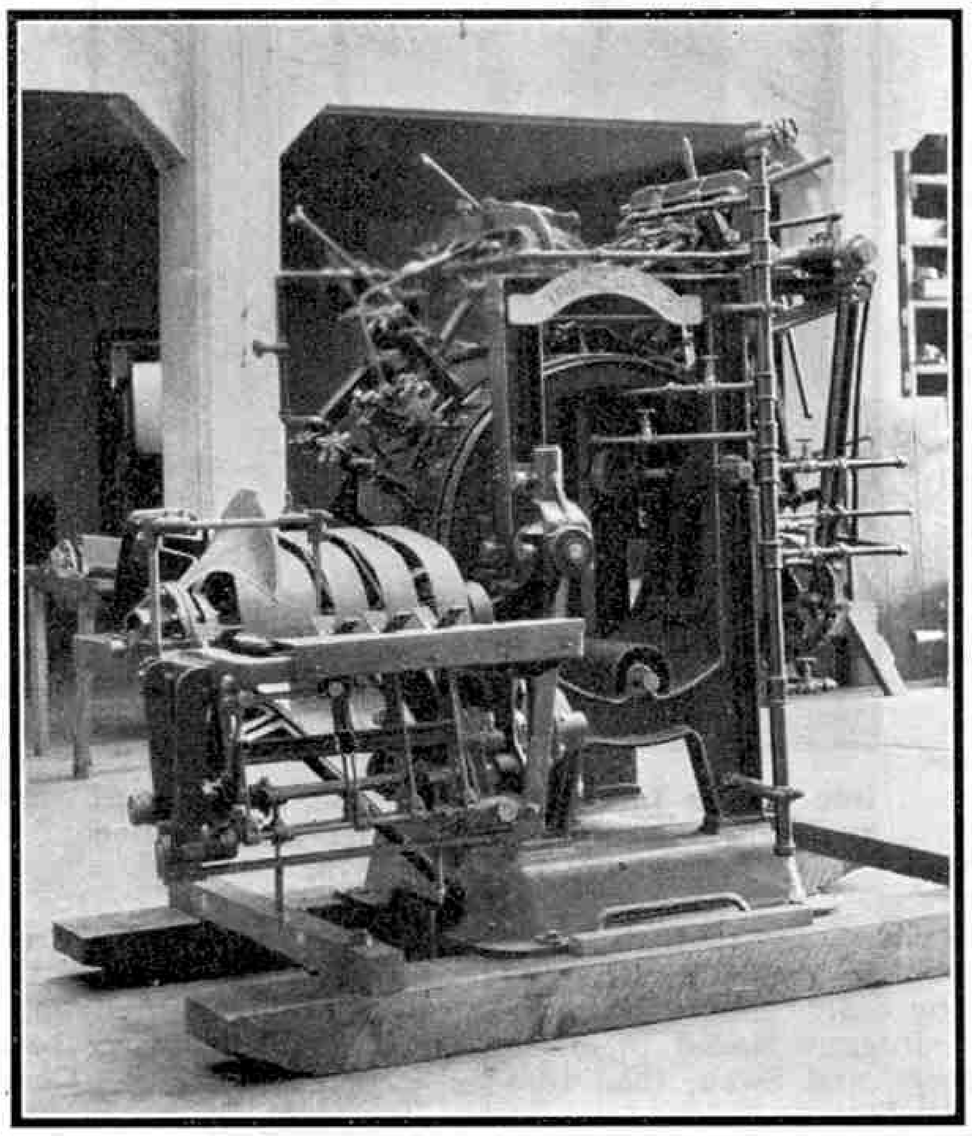
The manner in which salmon packing is carried on is one of the romances of industry, for throughout its career the fish that reaches us ready cooked in tins is scarcely touched by hand. Cleaning, cutting, canning and cooking are all carried on by means of intricate and ingenious machines that in the season are kept busy day and night preparing millions of tins of salmon for distribution to all parts of the world.

Many salmon canning factories resemble prehistoric lake dwellings in being built over water, the principal structures being erected on piles driven into the sandy bottom of one of the innumerable inlets on the Pacific coast of Canada and Alaska. A dock with wharves provides ample mooring space for the "scows" or shallow draught boats in which the fish are caught and brought to the factory. From the scows an elevator carries the fish to an overhead conveyor that loads into the main storage bins. These are arranged in pairs and their floors slope towards the centre, where gates or trap-doors allow the fish to slide forward on the first stage of the long journey that takes them to the shelves of provision dealers.

The progress of the fish to the tin begins on a second elevator, from which they slide down a chute into the bin that feeds the first of the machines used in the canning industry.

There is a Greek legend of a wonderful giant, Briareus by name, who had 100 hands and 50 heads. Awe-inspiring and capable as Briareus must have been, in the salmon canning industry he would now be considered out of date, for the cleaning machine first encountered by the fish does as much work as 60 men can do in the same time.

In former days Chinamen were largely employed in preparing the fish for canning and cooking. To-day practically every cannery has installed this remarkable machine, which has replaced the 120 hands of 60 Chinamen, and is therefore appropriately known as the "*Iron Chink.*" In ten hours it deals with 36,000 fish—an average of one per second—and it automatically removes heads, tails, fins, and entrails. Salmon of any size may be fed into it, for it adjusts itself to fish from 2 lb. to 20 lb. in weight, and does the work with far greater precision than the human hands it has replaced.



Courtesy] [*Smith Cannery Machines Co.*

The "*Iron Chink,*" a wonderful machine that prepares and cleans salmon of any size at the rate of 3,600 per hour !

At first glance the "*Iron Chink*" looks very complicated, but actually it is quite simple in operation. The accompanying diagram will help to show how it works. From the storage bin the fish slide down a wooden chute on to a table, the rate at which they pass on to the machine being controlled by means of a trap door connected with a foot lever. The workman who manipulates this lever also arranges the fish so that the heads all point in one direction. As the fish slide forward a second man picks up each one in turn and places it on the sharply pointed peg marked X, which passes through the gill just behind the head.

The "*Iron Chink*" now takes the salmon in hand. The fish is gripped by a carrier and conveyed under the rotating knife blade A, which neatly slices off the head. The remainder of the fish is then released by the first carrier, but is immediately gripped by a second that carries it in the direction of the dotted line, tail first, until it reaches B, where the tail is removed by another knife.

The body of the fish is automatically picked up by the large wheel and in the course of its journey meets a series of revolving knives. At C one knife removes the back fins; at D the remaining fins are dealt with in a similar manner; at E a third knife slits open the body, and cleaning mechanism immediately sweeps out the entrails. The knives are really rotating cutters, and with their guard blades they are pulled down against the fish by springs that exert just sufficient force to make them follow the contours of its body, no matter what size this may be.

Washing is the final operation performed on the wheel of the "*Iron Chink.*" This is carried out at the point F, where water under pressure is forced into the carcase. The fish is now perfectly clean and ready for slicing, and it is automatically released from the

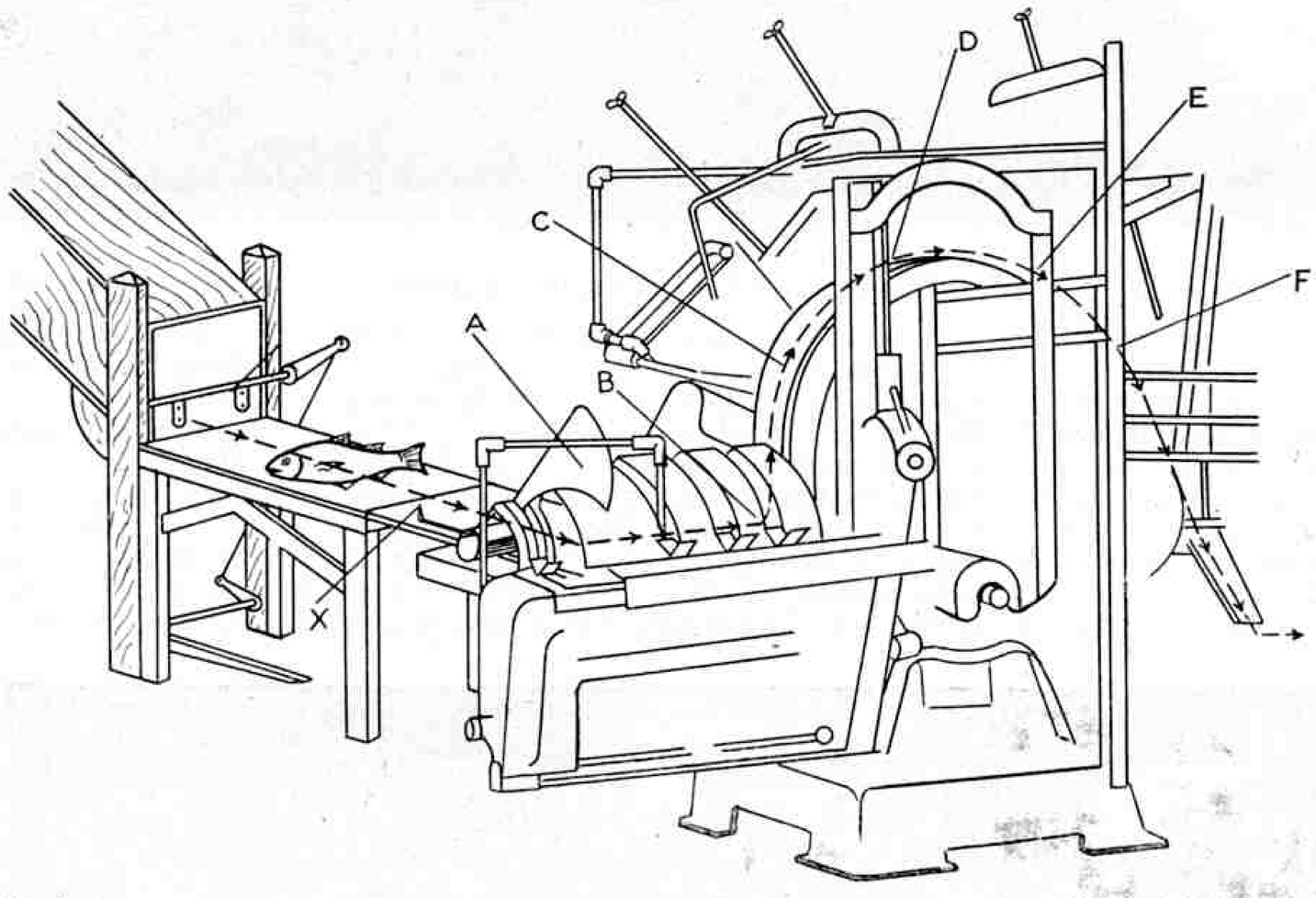
wheel and falls on to a belt conveyor that carries it forward to the cutting machine. The "waste" parts that have been removed from it are automatically conveyed from the "*Iron Chink*" into a special plant that converts them into products suitable for food or soap, and for dry meal for cattle and poultry food.

On leaving the Chink the fish are conveyed to what is called the "sliming" table, where they are inspected and further cleaning is done when necessary. An elevator then carries them forward to the slicing machine, which cuts them into pieces of suitable size. These travel to the filling machines, where they meet the cans, which are timed to reach the machine exactly when required to receive the slices of fish, the entire filling operation being automatic.

In the salmon-canning industry even salting is done by machinery, and at this stage an automatic device adds to each can the exact amount of salt required to make the cooked fish palatable.

After a final glance from an inspector the tins are ready for the lids. These are loosely placed in position and the cans are passed into the high speed vacuum closing machine. In this the air is removed from the interior of the cans and the lids are firmly clinched in position leaving the tins airtight.

The salmon is now ready for cooking. For this purpose the tins are washed and placed on trucks that carry them into one of the long cylindrical cooking retorts usually employed. These are of enormous size and in each more than 4,000 cans of fish may be cooked at one time. The tins remain in them for about 90 minutes, during which time a regulating device keeps the temperature constant at 240°F. After cooling off, the cans are labelled—again by machinery—and boxed up in cases ready for shipment to all parts of the world.



Courtesy ["*Pacific Fisherman*"

How the "*Iron Chink*" works. The salmon follow the course indicated by the dotted line, and when they emerge are ready for slicing and canning.

In few industries is the use of machinery carried as far as it is in salmon-canning, and a recent development promises to reduce even further the time and labour necessary. This is the introduction of floating canneries, or vessels that catch the fish and return to port with the salmon canned, cooked, and labelled ready for the market.

One of the most successful of these floating canneries is "*The International*," a vessel that operates on the Alaskan coast. She is of 2,715 tons burden, and during a recent run 25,000 salmon were caught and packed between 4 a.m. and 4 p.m. on the same day. This is an excellent day's work, for it is an average of more than 2,000 an hour.

It is interesting to note that in this respect the salmon industry is following the example of whaling. Vessels in which whales are cut up and the oil extracted while still at sea are now employed with great success, and it is by no means impossible that similar methods will be adopted on an equally large scale in dealing with the salmon.

Famous Inventions—(*Continued from page 361*)

in Europe on which the interior of a building was illuminated by electric incandescent lamps.

During 1878 the famous American inventor, Thomas Alva Edison, became interested in the subject of electric lighting and set to work, quite independently of Swan and Stearn, to evolve a practical incandescent lamp. From time to time reports of remarkable progress made by Edison reached this country, and Stearn urged Swan to patent the incandescent lamp that they had produced before their American rival forestalled them. Swan objected to doing this, however, on the ground that the principle of heating to incandescence a carbon conductor enclosed in an air-free glass bulb had been conceived and attempted by earlier experimenters, and therefore could not be regarded as wholly his work. Stearn did not accept this point of view, and his misgivings proved justified when, on 10th November 1879, Edison obtained a British patent in respect to an incandescent electric lamp. Even this demonstration of Edison's commercial keenness did not at first influence Swan's point of view, and although the English inventor took out a patent in the following year it was merely for his process of extracting all air and gases from electric lamp bulbs.

While Edison was busy with the electric lamp that he had patented, Swan, still aided by Stearn, continued to improve his own invention. A carbon conductor of hairpin form and fineness was substituted for the carbon rod, and gave gratifying results. Swan was not yet satisfied, however, and in his search for a more suitable filament he tested every substance that could be reduced to sufficiently fine proportions and seemed likely to form a suitable incandescent. He experienced many failures, but he persisted in his search and eventually he evolved a successful substitute from cotton treated with sulphuric acid. This treatment eliminated the fibrous nature of the material and reduced it to a plastic mass that hardened considerably on drying, but yet could be drawn out into the form of fine wire by passing it through a series of dies. In this condition the cotton filament was sufficiently flexible to be bent into any desired shape, while it retained its finished form after being carbonised. This new filament proved both strong and durable, and gave such an excellent light that Swan patented it on 27th November 1880.

The incandescent electric lamp was now a reliable and efficient source of light, and Swan decided that the time had come to manufacture such lamps in large quantities. Assisted by Stearn and a young electrical engineer named Crompton, who had become known as the inventor and maker of a very efficient arc lamp, Swan founded the Swan Electric Lamp Company at Newcastle, and established a factory at Benwell near that city. As no glass blowers sufficiently expert for the work could be found in this country experienced men were specially engaged from the Thuringia district of Germany, and a skilled assistant of Stearn's was brought from Birkenhead to teach them the art of blowing the special bulbs required.

We are indebted to the courtesy of Mr. Kenneth R. Swan, of London, for the portrait of Sir Joseph Wilson Swan and for the illustration of the Swan electric lamp.

Welded Bridge Built in Australia

An interesting reinforced concrete bridge has been constructed across a reservoir in Victoria, Australia. The structure carries the Western Highway, one of the main interconnecting roads in Victoria, and derives its interest largely from the fact that a number of the reinforcing trusses are welded together.

An old wooden bridge, 200 ft. in length, formerly occupied this position. The capacity of the reservoir was increased, and the resulting rise of 10 ft. in the level of the water made the construction of a new bridge necessary. The concrete structure now built is of the multi-span type. It is a little longer than its predecessor, measuring 264 ft. from end to end. The longest of the five spans of which it consists is the centre one, which measures 56 ft. The two adjacent spans are each 54 ft. in length, and the length of each of the remaining pair is 50 ft. The bridge is 32 ft. in width, and carries a roadway of 22 ft. that is flanked on either side by footwalks, each of which is 5 ft. in width.

British Record in Steel Construction

In the article *"Building with Steel"* that appeared on page 266 of the April number of the *"M.M."* reference was made to the record created during the building of the extension at Olympia, London, in preparation for the British Industries Fair held in February last. The steelwork was erected at the rate of 500 tons per week and in one week 680 tons actually were put up, this being about three times the previous record for Great Britain.

Even this remarkable feat now has been surpassed, for during work on the construction of a huge London office no less than 1,080 tons of steel recently were fixed in the same length of time.

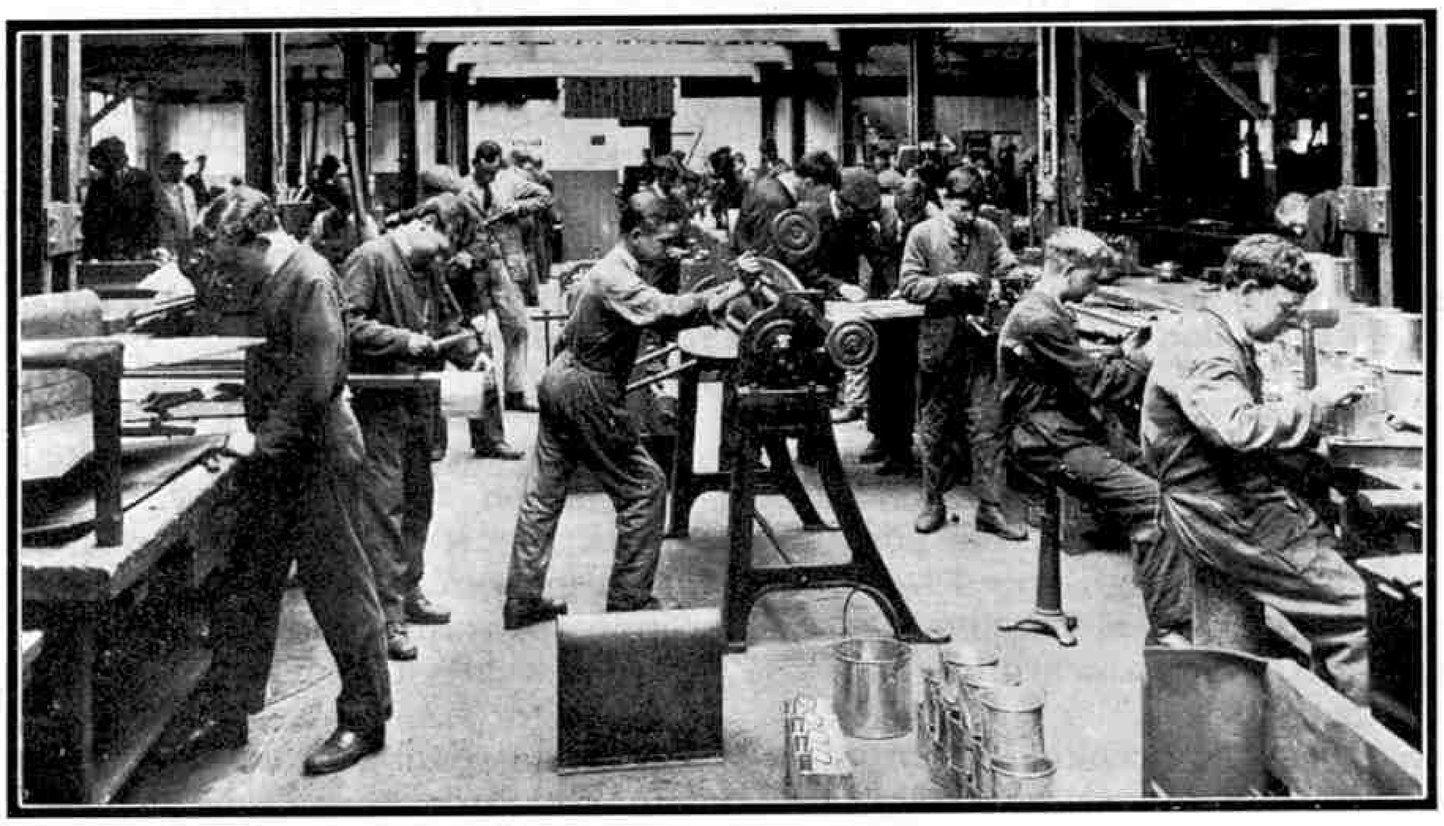
The building on which the record was made is in Grosvenor Road, and when completed will be the largest of its kind in London. Its framework is wholly of steel, of which about 12,000 tons will be incorporated in the finished structure. It is interesting to note that the contractors in both cases were Dorman, Long & Co. Ltd.

Proposed Bridge across the Humber

A short time ago, a number of eminent engineers were asked to examine the possibilities of either bridging or tunnelling the River Humber near Hull. After careful consideration they have decided that a bridge across the river is preferable to a tunnel. They also were asked to decide if the construction of a bridge to carry railway track was warranted. This is thought unnecessary, but it is expected that work on the construction of a road bridge across the river will shortly be commenced.

It is proposed that the bridge should extend from Hessle, about four miles west of Hull, to Barton-on-Humber on the southern shore of the estuary. The length of such a bridge would be about $1\frac{1}{4}$ miles and the main span would be 900 ft. in length. As the River Humber is used by large sea-going vessels, the deck of a bridge built across it must be at a height sufficient to allow shipping to pass underneath. For this reason the central section, 1,400 ft. in length, would be constructed at a height of 90 ft. above high water level. The bridge would have 23 smaller spans, 21 of which would be 250 ft. in length. Each of the two other spans would have lengths of 240 ft. The estimated total cost of the scheme is £1,725,000.

The construction of the bridge would greatly speed up road traffic between Hull and Grimsby, reducing the journey by 40 miles, while vehicles travelling between Hull and places south of the Humber would be saved a considerable detour.



Apprentices at work in the sheet metal bay of the Apprentice Department of the British Thomson-Houston Co. Ltd. of Rugby.

Giant Engines of Motor Liner *"Britannic"*

Interesting details of the White Star Motor liner *"Britannic"* have now been made public. This vessel is rapidly approaching completion at Belfast, and is scheduled to enter the Liverpool-New York service on 28th June.

It is stated that when in active service the twin 10-cylinder four-stroke double-acting motor engines of the *"Britannic"* will consume 80 tons of fuel oil in one day. In the same period each inlet, exhaust and fuel valve will function 70,000 times, and each piston will cover a distance of 280 miles, while the propellers will make no fewer than 140,000 revolutions.

In order to prevent overheating, 13,000 tons of fresh water will be circulated daily through the jackets and cylinder covers, while 16,000 tons of sea water will pass through the lubricating oil cooler, fresh water cooler and exhaust manifold before being discharged overboard. Great attention has been paid to the prevention of waste, and the heat given out by the exhaust is used to generate steam at 100 lb. pressure for general use.

The size of the vessel's engines may be realised from the fact that twelve of the biggest motor cars built could be parked on the floor space occupied by each bedplate. The exhaust and inlet valves are so large that when an engineer wishes to inspect the interior of a cylinder he simply removes a valve and climbs bodily through the opening thus made.

The crank-shaft of the engines weigh 185 tons. Connecting rods, crossheads and pistons are of corresponding size, but by means of compressed air the engines may be manœuvred with the greatest ease, and the act of reversal only occupies nine seconds.

It is interesting to note that, with the exception of the air compressor for feeding the cylinders with fuel oil, all the auxiliary machinery is electrically driven.

The owners of the *"Britannic"* are so confident of the merits of the vessel that a sister ship has been laid down. This is being constructed at Belfast by Messrs. Harland and Wolf Ltd.

Important Canadian Bridge Completed

A new bridge has been constructed across the North Saskatchewan River at Nipawin, a point about 75 miles east of Prince Albert, in Western Canada. The structure is expected to have an important effect upon motor traffic to the new settlements north of the Saskatchewan River, for it replaces a ferry system formerly in use, and abolishes all the inconvenience caused by the descent and ascent of the steep sides of the valley of the river.

The bridge is of steel, and has been under construction since October, 1928. It is 1,907 ft. in length, towers 150 ft. above the river, and is estimated to have cost approximately £400,000. It has two decks. One of these is for road traffic, and on the upper level runs the main line of the Canadian Pacific Railway to Prince Albert. The latter city is becoming an increasingly important railway centre. Construction is shortly to be commenced on a long extension from it across north-western Saskatchewan to Lac la Biche, Alberta, and authority has been granted for the building of a second line, with Prince Albert as a starting point, that will extend to Foster Lakes, about 250 miles north of the city.

Railway construction in northern Canada has been stimulated by the discovery of the enormous mineral resources now being exploited in the northern areas of Saskatchewan and Manitoba. In addition to the lines already mentioned, the Canadian Pacific Railway is to construct a third from Nipawin Bridge to Island Falls on the Churchill River. With other lines projected by the Canadian National Railways and the recently completed railway to Churchill on the shores of Hudson Bay, the new routes will greatly assist in the development of these important territories.

World's Largest Lathe

A huge vertical lathe that is claimed to be the largest in the world has been constructed in Germany. It is capable of machining water turbine castings that are more than 59 ft. in length and about 16.5 ft. in height, and it has been built for this purpose.

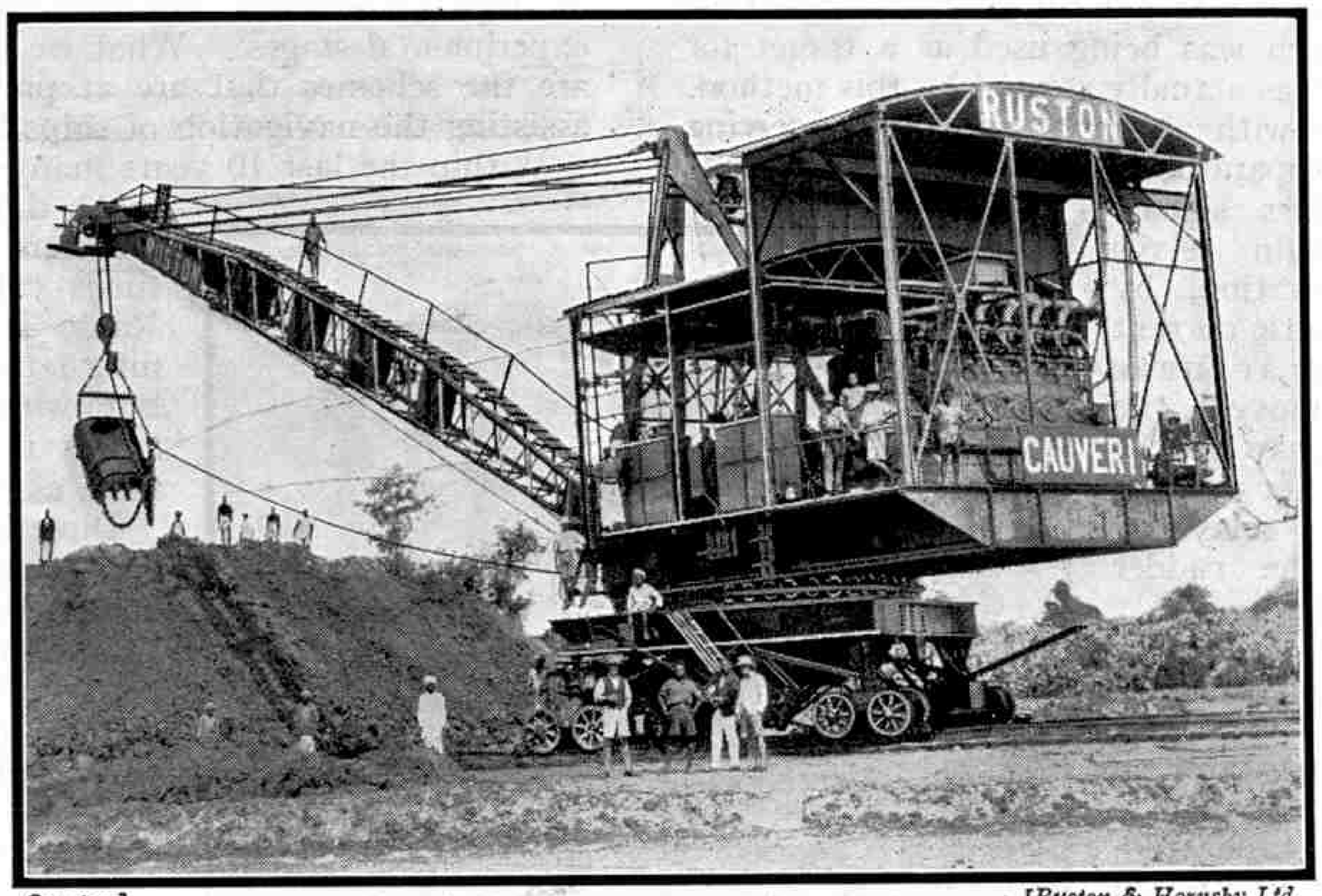
The lathe is driven by a 250 h.p. motor, and its weight is about 700 tons. The tool carriers are mounted on a bridge 72 ft. in length! This is so large that a gangway is provided along it in order to facilitate working.

England's Highest Crane

A mono-tower crane erected on the site of Liverpool Cathedral, now under construction, is claimed to be the highest in England. Its total height is 300 ft., and the radius of action is nearly 130 ft. The crane has been erected to raise the massive blocks of sandstone of which the central tower of the Cathedral is being constructed.

Australian Irrigation Scheme

A proposal has been made in Australia to put into operation a scheme for the irrigation of about 6,600,000 acres of land in the Riverina district of New South Wales. The initial area to be supplied with water is about 600,000 acres in extent and is situated on the border between New South Wales and Victoria. Later the scheme will be extended to the remaining 6,000,000 acres. If the suggestion is carried out, the water required will be obtained from the Rivers Murray, Edward and Wakool.



Courtesy [*Ruston & Hornsby Ltd.*

A rear view of a mammoth dragline excavator. This illustration clearly shows the powerful steam power plant that operates the huge machine.

First British Aluminium Tramcar

What is probably the first British tramcar in the construction of which aluminium alloy is used to any great extent has been put into service in Birmingham. The chassis of the vehicle appears to be of the normal type, for it has a steel underframe and the lower saloon floor is made of wood; but the rest of the bodywork of the car is of aluminium alloy construction. The car was designed and constructed by Short Bros. (Rochester and Bedford) Ltd., the well-known constructors of all-metal aircraft and seaplane floats, and although the car possessed numerous unique features, no constructional difficulties were experienced by the makers while it was being built.

The use of aluminium alloy enables an extraordinary saving of weight to be made, a tramcar of the same size constructed in the ordinary manner weighing three tons more. The actual weight of the new car is 13 tons 12 cwt. Its overall length is 33 ft. 6 in., its width 6 ft. 3 in., and the heights of the lower and upper saloons are 6 ft. 3 in. and 5 ft. 10½ in. respectively. A total of 63 passengers may be carried at one time, 27 being accommodated in the lower saloon and the remaining 36 on the upper deck.

During the period that the tramcar has been in operation its performance has been found to be considerably above that of the standard Birmingham cars. Not only are its acceleration and deceleration powers better, but the current used is appreciably less.

Launch of Two British Destroyers

Two new British warships were launched a short time ago. The first of these, H.M.S. *"Active,"* was built at the Tyne shipyards of R. & W. Hawthorn, Leslie & Co. Ltd., and was the first torpedo-boat destroyer to be launched on the Tyne since the Great War. The second warship also is a destroyer. This was constructed at the Woolston yard of John I. Thornycroft & Co. Ltd., and has been named the *"Acheron."* This vessel is unique in that it is the first naval vessel to be equipped with a power plant employing high-pressure superheated steam in combination with air preheaters.

H.M.S. *"Active"* has now successfully completed her preliminary acceptance trials. She has an overall length of 323 ft. and a displacement of 1,330 tons. Twin-screw single-reduction geared turbines are installed in the vessel and the total power developed is 34,000 s.h.p. Steam is raised in three water-tube boilers, each fitted with superheating apparatus that raises the steam to a final temperature of 412°F, and working pressure is 300 lb. per sq. in.

The Thornycroft-built vessel, H.M.S. *"Acheron,"* is 312 ft. in length between perpendiculars and has a displacement approximately equal to that of the *"Active."* She is fitted with Parsons steam turbines and twin screws that are driven through gearing. A speed of about 35 knots has been aimed at and it is expected that the vessel will quite come up to expectations.

H.M.S. *"Acheron"* is equipped with four 4.7 in. guns, two 2-pounder pom-poms, five machine guns and eight 21 in. torpedo tubes. She is the 101st destroyer that has been constructed for the British Admiralty by Thornycrofts.

Zuyder Zee Reclamation Scheme

The scheme for reclaiming the Zuyder Zee, preliminary details of which were given on page 613 of the *"M.M."* for August, 1929, has now been carried a stage further. In February last the first two pumping stations were officially put into operation by the Dutch Minister for Dykes and Waterways.

The two stations have been erected for the purpose of de-watering the north-west polder, which is 490,420 acres in extent. One of them is situated at the eastern end, and the other in the south of the Island of Wieringen. The powerful pumps installed in them are lowering the level of the water at the rate of slightly over three quarters of an inch per day, and it is estimated that the task will take eight months to complete.

The eastern station is equipped with two six-cylinder oil engines, each driving a pump having a capacity of 17,655 c. ft. per minute. In the southern station there are three pumps each with a capacity of 15,890 c. ft. per minute.

The Navigation of Ships by Wireless

By Lt.-Col. Chetwode Crawley, M.I.E.E.

JUST before the War the Admiralty were investigating the problem of steering a ship that had no crew on board by transmitting wireless signals from a station on shore, but it was not till after the War that an old warship, which was being used as a target for naval gun practice, was actually steered by this method. The ship was fitted with an aerial wire and receiving apparatus. This apparatus was designed so that when certain wireless signals were received certain relays were put into operation, by which means an electric current was allowed to actuate mechanism that moved the rudder of the ship, say to the right. Similarly, other wireless signals worked other relays by which eventually the rudder was moved to the left.

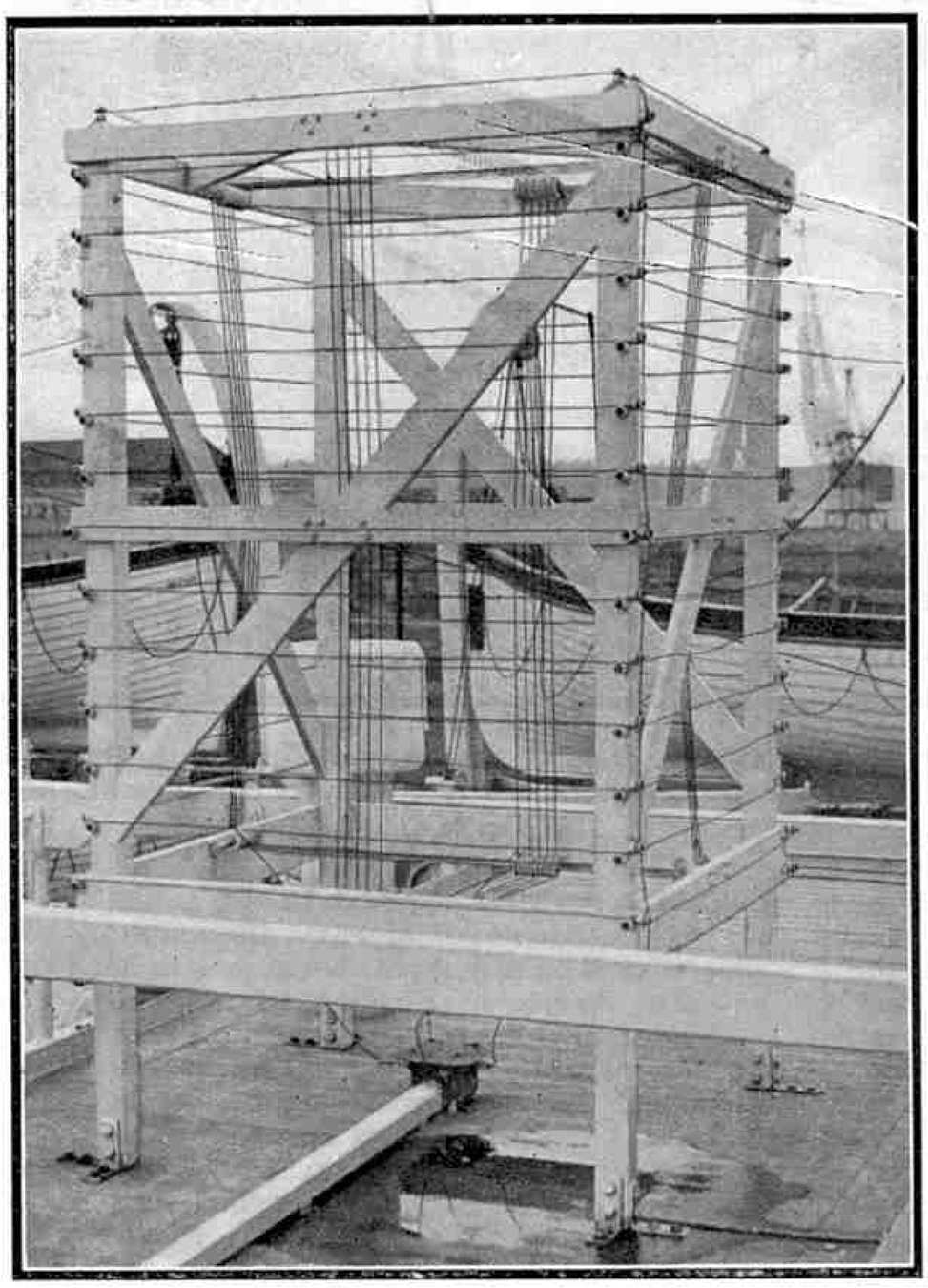
The experiment was quite successful, and has been repeated on several occasions, both in this country and in America. The arrangement is of course rather complicated, and also it is very limited in application as it is seldom that the need arises for steering ships without crews on board. But the fact remains that ships can be steered over comparatively short distances, under good weather conditions, by means of wireless signals.

Another interesting experiment was carried out a few months ago by the Admiralty at Portsmouth. On this occasion a warship was actually steered by wireless out of Portsmouth Harbour and past the Isle of Wight into the English Channel. The transmitting aerial was laid on the bed of the sea along the course on which it was desired that the ship should proceed.

The vessel was fitted with two receiving aerials, one on the port side and one on the starboard side. When the ship was exactly over the transmitting aerial the electric currents received in the receiving aerials were equal, and therefore the steering gear held the rudder in a central position. As soon as the ship went off the course, however, on account of water currents, wind, etc., it was no longer exactly above the transmitting aerial, with the result that the electric current received in one of the ship's aerials was greater than that in the other. This brought into action a certain set of relays that released an electric current, which actuated machinery that moved the rudder in such a direction as to bring the ship back on to its proper course. This experiment, too, was quite successful, and it may be that applications of this principle will come into use for certain purposes in the future.

These are the latest developments in the navigation of ships by wireless, but they are only in the earliest experimental stages. What we really want to consider are the schemes that are at present in actual use for assisting the navigation of ships by wireless telegraphy.

Within the last 10 years many ships have been fitted with directional wireless receivers, or as they are sometimes called, radio compasses. Radio is the word now used internationally for wireless, but wireless is more familiar to us in England and so we may as well stick to that.



A ship's directional aerial inside an earthed screen.

Directional wireless receivers are mainly of two kinds, one with a small loop aerial in the form of a vertical metal ring on top of the wireless cabin; and the other with an aerial consisting of two larger vertical wire loops at right angles to one another.

In the first case the ring can be rotated on a vertical axis by the operator turning a handle in the wireless cabin. If wireless signals are being received from a distant ship or station the operator finds that by turning the handle he varies the strength of the signals, and that the signals are at their weakest when the plane of the aerial ring is at right angles to the direction of the transmitter. If the plane of the ring is then in, say, a north-south direction, the transmitting ship or station is either east or west of him; and by a certain adjustment of his receiving apparatus he can determine whether the sending station is actually to the east or to the west. In practice, when the operator turns the handle a pointer moves over a compass card, and he can read off direct the bearing of the ship or station that is sending signals when he gets to the position where these sound weakest.

In the second case, where the aerial loops are fixed in position, the operator turns a handle that rotates a coil of wire in the receiving circuit, and the whole procedure is just the same, the pointer in this case being attached to the rotating coil instead of the rotating aerial.

Ships fitted with these directional receivers can obtain their bearings from any ship or station within an accuracy of two degrees, up to a range of 100 miles or so, when conditions are favourable; and a bearing of within two degrees is, as a rule, sufficiently accurate

for navigational purposes. It is obvious how useful such apparatus must be in case of fog, but up to the present no ships have been compelled by law to carry it. A few months ago, however, an International Conference on the Safety of Life at Sea met in London, and one of the rules laid down was that, after 1st July, 1931, all passenger ships of over 5,000 tons must be fitted with directional receivers. As a matter of fact nearly all large passenger ships of all nations have already adopted this apparatus voluntarily, to assist navigation in foggy weather and for general safety purposes.

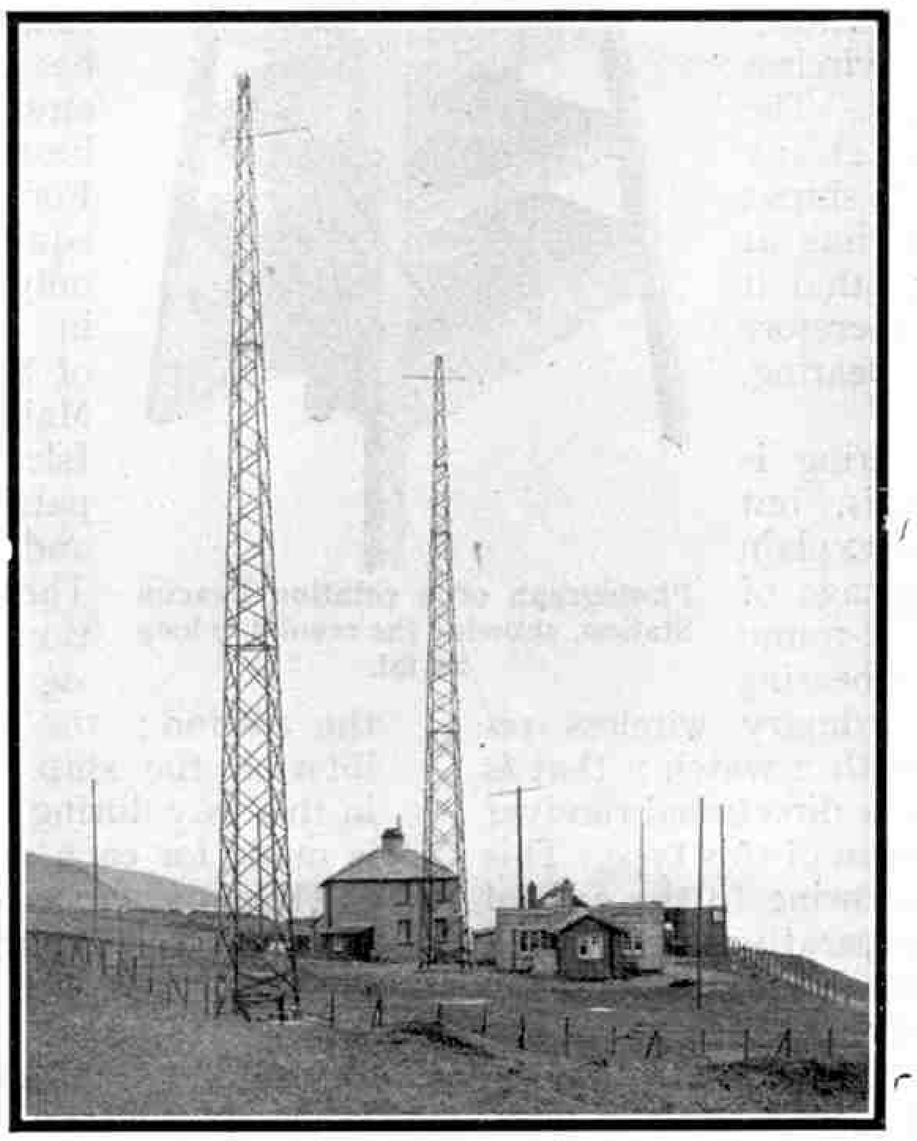
We have mentioned that these receivers give accurate results only when conditions are favourable. That does not mean weather conditions, but electrical conditions in the ether, for it must be understood that wireless waves are waves in the ether, not in the air. Very little is known about conditions in the ether, but fortunately, in this case, that is not important in practice, because an experienced operator can tell from the kind of signals he hears whether conditions are favourable or not. If they are not favourable he knows that the bearings may be inaccurate, and he reports them as unreliable.

The bearing obtained by this method is the bearing of the transmitting ship or station from the direction in which the ship's head is pointing, so that arrangements must be made for noting this direction at the moment when the bearing is observed by wireless. All this sounds very complicated, but it is not so in practice; and with a little experience a wireless operator soon becomes proficient in obtaining bearings by wireless telegraphy.

A ship can of course obtain its position if it can obtain two bearings, first from one station and then from another. The operator reports the two bearings, and the navigator draws lines at those bearings from the two stations on the chart. The point where the two lines intersect will give the position of the ship. More accurate results can be obtained if there is a third station from which a bearing can be taken and a line from it also drawn on the chart, but it is not often that three convenient stations are available at the same time for this purpose. As a matter of fact directional apparatus in ships is far more often used for obtaining the bearing of a ship from a station or from another ship than for obtaining the actual position of the ship.

At first sight it might appear that there is not much use in one ship obtaining the bearing of another ship, as the positions of both are altering and neither of them may be sure of its position. It may be very useful indeed in certain circumstances, however. For instance, if a ship that is ignorant of its exact position is in distress, and another ship that is coming to the rescue is able to take bearings on it, a direct course may be steered toward the ship in distress, with the result of a great gain in time. Many instances of this have occurred, and many lives have been saved in this way by directional apparatus. Again, suppose two ships are approaching each other in a fog. How useful it is then for them to be able to take bearings on one another, and thus be able to avoid the possibility of collision, which may be averted by altering their courses, if necessary.

A Coast Station with a directional receiving aerial of the small single loop pattern.



View of another Coast Station showing the short masts that stay out a directional receiving aerial of the large double loop pattern.

The coast stations in this country that communicate by wireless with ships are under the control of the Postmaster General, and are worked by employees of his Department. Any ship fitted with directional apparatus may obtain its bearing from one of these stations. The ship calls up the station and asks it to transmit its call sign, which consists of a group of three letters, for two minutes continuously; and the ship obtains its bearing by receiving the signals on its directional apparatus. There are eleven stations round our coasts from which ships can take bearings in this manner, and a charge of five shillings is entered up against the ship for each bearing obtained.

In addition, a number of coast stations are being erected for this purpose alone, and these stations are called radio beacons. They correspond to lighthouses, but instead of transmitting flashes of light at definite intervals they transmit their call signs by wireless telegraphy whenever the weather is foggy, and at longer intervals when the weather is clear. These signals are sent out automatically, so that ships do not have to communicate with the stations at all, but just take bearings whenever they are in need of them.

Eight of these beacon stations are now working and, as they are being found to be very useful, several more will be erected in the near future. This is a new development of wireless, and at present the total number of beacons all over the world is only a little more than 100, about half of which are in the United States of America.

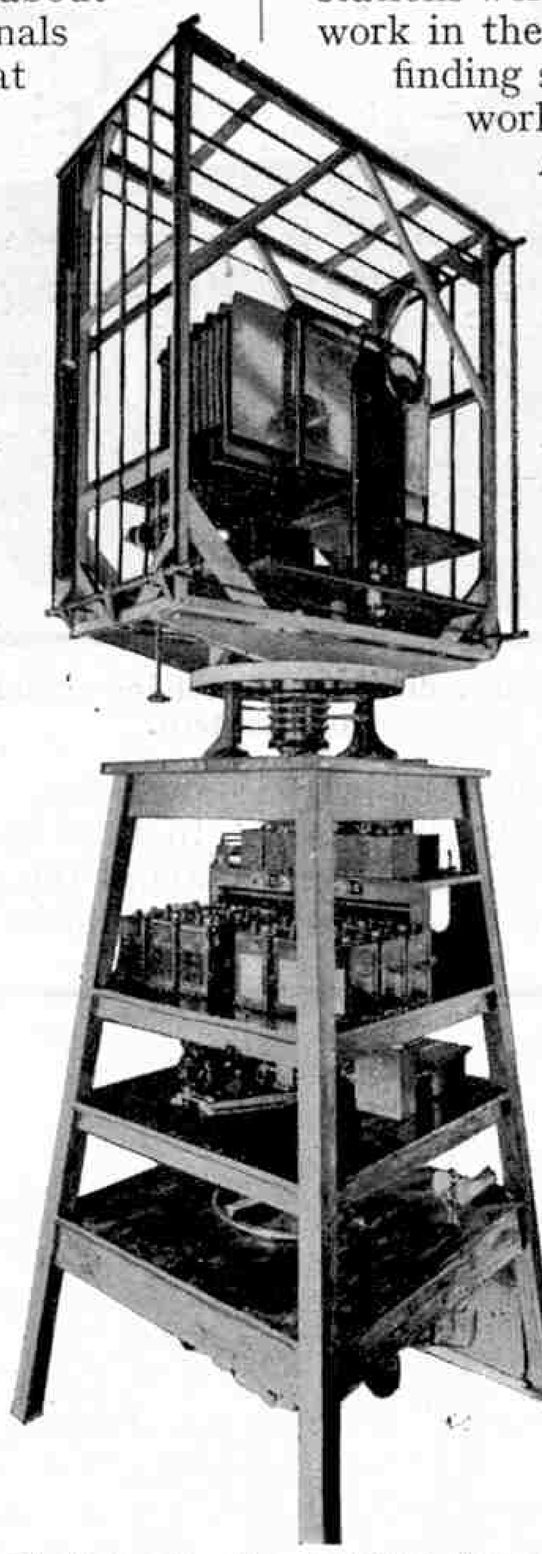
A few of these beacon stations also send out submarine sound signals at the same time as the wireless signals. The sound signals of course take a much longer time to reach the ship than the wireless signals, as sound in water travels at a rate of only about 5,000 ft. per second, whereas wireless signals travel at about 186,000 miles per second, that is instantaneously for all practical purposes. By a simple calculation, therefore, the ship can obtain its distance from the beacon, as well as its bearing. This is a great advantage from the navigational point of view, but this type of beacon is more expensive to erect and operate than the simple wireless beacon.

These radio beacons, like the ordinary broadcasting stations, send out signals in all directions, and are of course only of use to ships fitted with directional receivers. The latest development in this line is the rotating radio beacon that has recently been erected at Orfordness in Suffolk. There is no other station of this pattern in the world, and for the present it must be looked upon as merely in the experimental stage. Instead of sending out signals of equal intensity in every direction at the same time, this beacon sends out a rotating beam of wireless signals, consisting of its call sign. The direction in which the beam is sent at any given time is published and known to ships; so that if a ship notes the exact time at which it hears the signals it knows that it must then be in the beam, and therefore knows the direction, that is the bearing, of the beacon at that time.

The process of obtaining a bearing is not really quite so simple as this, but this short explanation will suffice to explain the general principle. The advantage of such a beacon over the present all-round type is that a ship can obtain its bearing from the beacon by using its ordinary wireless receiving apparatus in conjunction with a watch; that is to say, a ship that is not fitted with a directional receiver can take a bearing on a beacon station of this type. This is a most important advantage, as owing to the cost of directional receivers few ships, comparatively, are fitted with such apparatus. The great disadvantage is that the rotating beacon is more expensive to erect and to maintain in working order than is the all-round beacon.

The rotating beacon has not yet proved itself in practice, so it would be useless to prophesy whether this form of beacon will come into extensive use as a means of assisting the navigation of ships. In regard to aircraft, however, in which there are much greater difficulties in installing directional receiving apparatus, there is obviously a wide field for the use of rotating beacons at aerodromes, for the purpose of assisting in aerial navigation. It is a matter of interest in this connection that the Zeppelins that invaded England during the War were, in many cases, assisted in maintaining a course by wireless beams transmitted for the purpose by stations in Germany.

Directional wireless was used for many other interesting purposes in the War, such as for locating the positions of German submarines when they came up to the surface and made wireless signals. The present writer indeed supervised the erection of two directional stations for this purpose. The first submarine heard was unfortunately located as being somewhere in Spain, but subsequent attempts were less unsatisfactory! These particular stations were abroad, but the most interesting directional work in the War was that carried out by the direction-finding stations in this country. The climax of this work was reached when it was reported to the Admiralty that signals intercepted from the German Fleet indicated, judging from the directions from which the signals were being received, that the whole fleet was coming out into the North Sea. Our Grand Fleet was at once ordered out from its base in Scotland, and joined battle in the great sea fight of the War, the Battle of Jutland. It was the first, and the last, time that the German main fleet set out to the open sea.



Photograph of a rotating Beacon Station, showing the revolving loop aerial.

As we have already noticed, the number of ships fitted with directional receivers is small, in fact less than 5 per cent. of the British ships that are fitted with wireless are equipped with directional apparatus, so that the great majority of ships cannot themselves take bearings on shore stations. If the Orfordness rotating beacon is a success, more stations of that type may be erected for the purpose of allowing any ships fitted with wireless to obtain bearings, but that is for the future. For the present, ships that are not equipped with directional apparatus can only obtain bearings from six stations in this country—Wick in the north of Scotland, Cullercoats near Newcastle, Mablethorpe near Hull, Niton in the Isle of Wight, Lizard in Cornwall, Portpatrick on the west coast of Scotland, and Malin Head in the north of Ireland. These stations are fitted with directional receivers. A ship sends its call sign continuously for two minutes to the station; the station takes the bearing, and then informs the ship. Nearly 10,000 bearings are taken in this way during the year, and a charge of five shillings is made for each one given by a station.

The importance of these land stations which can give bearings to ships will of course decrease as the number of ships that are themselves fitted with directional receivers increases. Such ships may obtain bearings from any land stations, or from other ships fitted with wireless.

The present state of affairs may be summed up as follows. Less than 5 per cent. of ships that are fitted with wireless are equipped with directional receivers. These ships can take bearings on beacon stations, ordinary coast stations, and on other ships fitted with wireless. The remaining ships can only obtain bearings from stations (six in this country) or other ships that are equipped with directional receivers, or from rotating beacons such as the one being tried at Orfordness.

Ventilation in Sleeping Cars

An Interesting L.M.S. Experiment

IN the early days of railways one of the greatest problems with which designers of passenger vehicles were confronted was that of providing adequate ventilation, without at the same time introducing draughts. This difficulty, of course, became greater as the speed of trains increased. Great progress has been made in this direction, but even to-day the ordinary non-corridor type of compartment is far from perfect as regards ventilation, and every railway traveller is familiar with the arguments that crop up as to whether the windows shall be opened or closed! The conditions are vastly superior in the modern sleeping and dining cars, and in these vehicles the traveller is assured of a very high degree of comfort. Railway companies do not rest content with what has been accomplished, however, but are constantly experimenting with a view to bringing about further improvements.

End view of coach fitted with "Punkah" ventilating system, showing the oil filter.

A short time ago the L.M.S. decided to try the experiment of equipping one of their first-class sleeping cars with the "Punkah" ventilating system of Thermotank Limited, of Glasgow, and a few particulars of the installation will be of interest. This system has been adopted extensively for shops but its application to railway trains was a new departure.

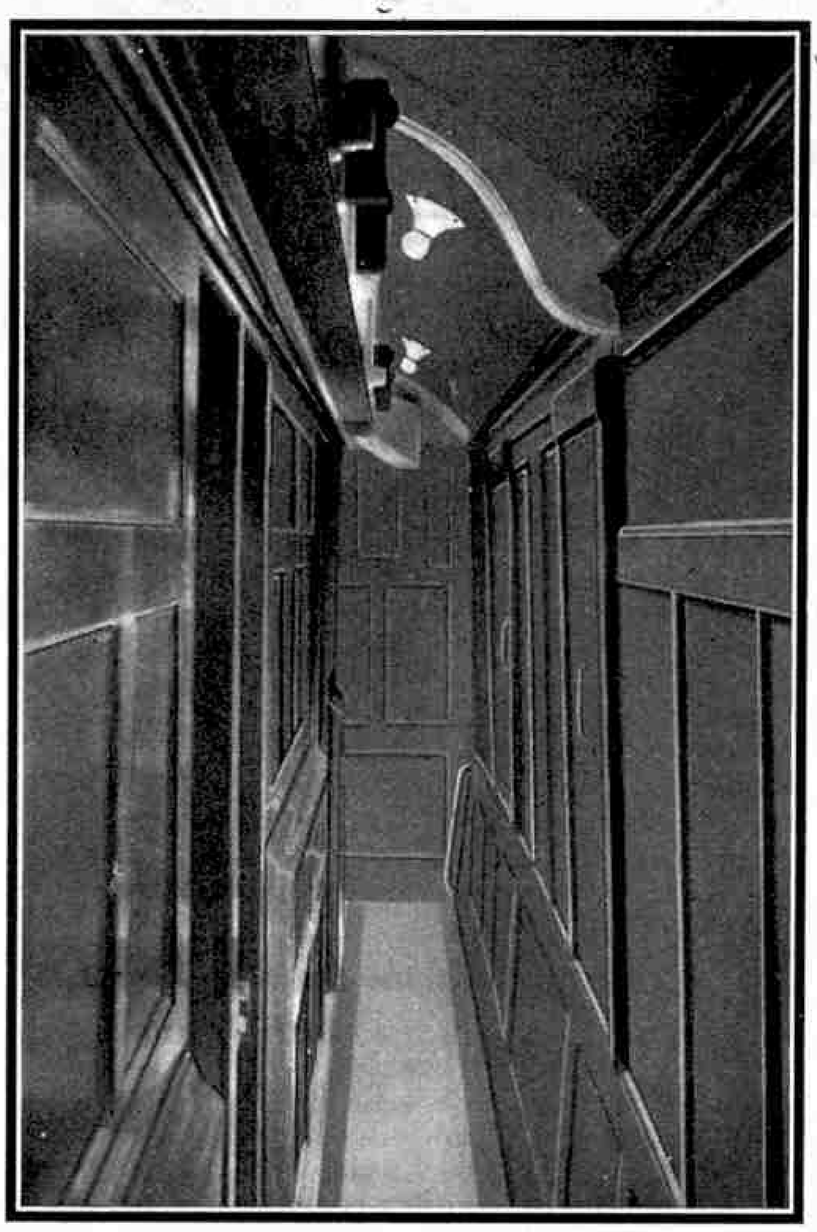
For this purpose was selected an existing coach having twelve berths and an additional compartment for the attendant. Each of the compartments is fitted with a patent "Punkah" Louvre which in the berths is fixed just above the cornice moulding and over the head of the bed. An air trunk or duct at the same height as the louvre is run along the whole length of the corridor at the junction of the partition and the roof, connection being made to the louvre by a hole cut through the corridor partition.

A ventilating equipment consisting of a centrifugal fan direct coupled to a 250-watt electric motor is housed in the linen cupboard situated at the end of the coach. This motor is designed to work on the 24-32-volt circuit and is supplied with energy from the ordinary lighting equipment. Variable control is provided giving four degrees of fan speed and the controls are placed in the attendant's compartment, a pilot lamp being incorporated to indicate when the fan is "on."

Integral with the fan casing is a valve arrangement by means of which the fan may be set to deliver air to the berths or to extract air from them. The position of this valve is controlled by a lever accessible through a small door in the linen cupboard. An alternative means of air supply to the fan chamber is also provided whereby air may be drawn either from outside the coach or from the vestibule.

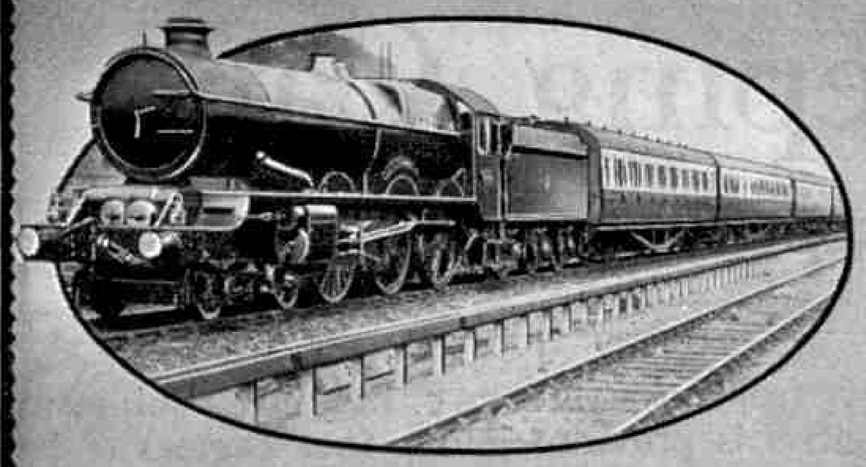
Air from outside is drawn through a viscous oil filter fixed in the coach end and protected by a cowl. At the bottom of this cowl is a butterfly valve controlling the air inlet and this may be opened or closed by a spindle actuated from the gangway by a carriage door key. Air to be drawn from the interior of the coach is admitted to the fan chamber by means of a sliding panel forming part of the inspection door of the chamber. Only one of these air inlets is open at a time, and either of them may be used as the outlet for the air when the fan is exhausting. The oil filter is readily removable through the inspection door of the chamber, and a spare filter is available for insertion while the dirty one is being cleaned. The capacity of the fan is sufficient to supply each berth with about 40 cu. ft. of air per minute, a quantity sufficient to ensure adequate ventilation. The actual volume of air entering the berth is of course under the control of the passenger the whole time.

Under the preliminary tests the installation gave good results. It was anticipated that an excessive amount of smoke and fumes would be present in the air discharge when the coach was passing through tunnels and the fan was drawing air from outside the coach. This fear proved to be groundless, for the air supply remained satisfactory.



Photos courtesy [*Thermotank Limited*

The ventilating equipment in the carriage roof.



THE DOWN CHELTENHAM EXPRESS

RAILWAY NEWS

New Royal Mail Vans

Three Post Office stowage vans have been built at the L.M.S.R. Wolverton works for postal service. Although intended primarily for stowage purposes, the vehicles are so constructed that, should the necessity arise, they may be readily altered into Travelling Post Offices. They are painted in L.M.S. standard colours, with the words "Royal Mail" in bold lettering on each side.

The underframes and bogies of steel are constructed to the Company's standard designs, and are fitted with shock absorbing buffers, vacuum automatic brakes and steam heating, whilst the batteries and dynamo for lighting purposes are hung underneath.

The bodies are of oak and teak framing with steel panelled sides and ends. They are 50 ft. in length, 8 ft. 6 in. in width and 8 ft. 4⅛ in. in height, and are fitted with sliding doors, a net recess on the near side and two sliding doors on the off side. The floors are of dovetail corrugated steel sheeting and covered with Decolite flooring composition.

Heating is carried out by means of Westinghouse vertical heaters and a 2 in. pipe carried along the roof of the carriage, and electric lighting is provided by means of 60-watt lamps in the centre of the roof.

Courtesy [*L.M.S.*

One of the three new Post Office stowage vans built at the Wolverton Works of the L.M.S. When necessary these may readily be converted into Travelling Post Offices.

A Wonder Wagon Train

One of the most remarkable trains ever run in this country recently was seen at Sheffield Victoria Station. It was hauled by the largest, heaviest and most powerful engine in Great Britain—the "Garratt" freight locomotive of the L.N.E.R.—and adjoining the engine was the largest and heaviest wagon in the country, having 56 wheels and being capable of carrying material and machinery up to 150 tons in weight.

The remaining portion of the train consisted of 18 to 20 wagons of special types varying from 50-ton brick wagons to 40-ton coal wagons, banana vans and a number of the latest steel and insulated containers. This wonderful train was assembled to demonstrate the facilities that the railways offer for moving heavy machinery and various classes of merchandise.

L.N.E.R. Locomotive News

Six more 0–6–0 goods engines of the J39 class have been built at Darlington; of these Nos. 1487, 1489 and 1491 are to work on the N.E. section, and Nos. 2786, 2787 and 2788, in the Scottish area.

One of the "Z" "Atlantics"—No. 2163—has been equipped with a feed-water heater of the Dabeg type.

It has been decided that 190 engines shall be broken up in the course of the present year. Most of these are goods and tank engines but quite a number of passenger express engines of old familiar types are included in the ranks of the doomed. In the North Eastern area, 11 engines of the B13 4–6–0 class, and 22 of the D22 and D23 4–4–0 classes, are to be scrapped. Twenty of the engines originally built by Mr J. Holden for the Great Eastern Railway are to go. These are:—ten passenger engines of the D13 4–4–0 class and ten mixed-traffic engines of the E4 2–4–0 class. The last five of the 4–4–0 engines with 7 ft. driving wheels that Mr. M. Holmes built for the North British Railway, also are scheduled for destruction.

Fast Run on the L.N.E.R.

The L.N.E.R. report that the "Harrogate Sunday Pullman" recently covered the 186 miles from Leeds to King's Cross in 187 minutes, the 156 miles from Doncaster being covered in 148 minutes at an average speed of 63.2 m.p.h. The engine, No. 4419, was manned by Driver W. Barnes and Fireman T. Barker.

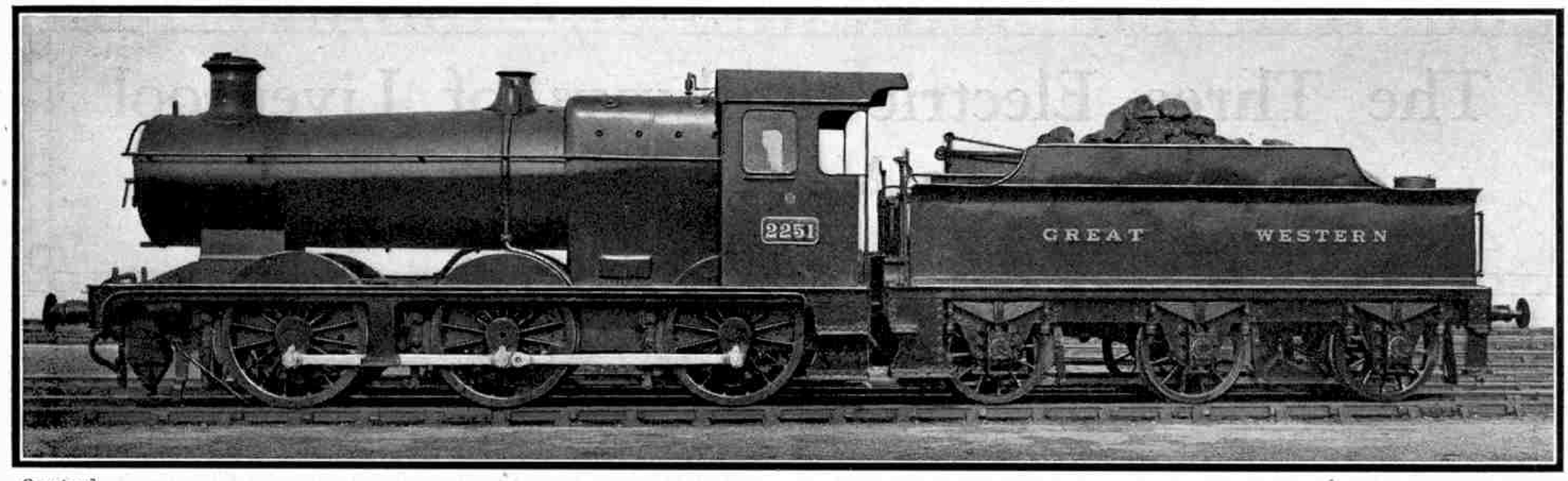
Developments on L.M.S.

The 20 engines of the 2–6–0 mixed-traffic type now building at Horwich are numbered 13130 to 13149. "Claughtons" Nos. 5917 and 5955 have been adapted for working on the Midland section, and No. 5942 has been altered to fit the Northern loading gauge. Among other engines that have had their cabs altered to suit the Midland gauge are Nos. 5337, 5353, 5388, "George the Fifth" class; No. 5506 of the "Experiment" class; and Nos. 5621, 5710, 5728, 5752, of the "Prince of Wales" class.

Amongst the engines recently withdrawn from service are a number of goods engines of various types and also two passenger engines. These are No. 5468, "*Lady of the Lake*," "Experiment" class, and No. 5143, "Renown" class.

Of late years, engine painting and cleaning on the L.N.W. section seems to have been reduced to a minimum, with the result that many of the engines, even on the best expresses, have appeared in a deplorably dirty condition. It is gratifying to note that recently there has been decided improvement in this respect, and engines are being turned out in much smarter, cleaner condition. The new black livery now used for many of the older passenger locomotives is plain, but when clean, the engines have quite a trim appearance. It is worthy of remark that engine No. 5964—an unrebuilt "Claughton" that "in memory of the fallen L.N.W.R. employees, 1914–1919" is named "*Patriot*"—is painted "Midland" red and kept in clean condition.

The reorganisation—or "rationalisation"—of the works at Crewe has brought about a striking change in the time spent on the repair of locomotives. Two years ago the shortest time for a locomotive to be out of traffic for heavy repairs was twelve days. That time has now been halved. In 1920, a particular type of engine needing heavy repairs was out of service for two and a half months. In 1925, the time was reduced to five and a half weeks. In 1927 it was brought down to twelve days, and in 1930, to forty-seven working hours. Thus in six years the number of engines undergoing or awaiting repairs has fallen from 1958 to 554.



Courtesy] [*G.W.R.*

G.W.R. locomotive No. 2251, the first of a new type of 0-6-0 tender engines designed for branch services and main line traffic.

New G.W.R. Six-coupled Locomotives

In view of the advanced age of the majority of G.W.R. 0–6–0 locomotives, it has been decided to construct a number of up-to-date locomotives having the same wheel arrangement. They will be used for branch services and light main line traffic, and will replace on these duties engines of older types that are in need of renewal. The first of a batch of 20 of the new type is now in service. This is No. 2251, an illustration of which is reproduced on this page.

The design incorporates the standard No. 10 pattern boiler with a total heating surface of 1,247.5 sq. ft. and a working pressure of 200 lb. per sq. in. The dimensions of the cylinders are 17½ in. diameter by 24 in. stroke, and the driving wheels have a diameter of 5 ft. 2 in. The tractive effort at 85 per cent. of the working pressure is 20,155 lb. Thus the new locomotives are considerably more powerful than those they are to replace, for their tractive effort is only 15,685 lb.

The cabs of the new locomotives are of the modern side-window design that now is fitted to all G.W.R. tender engines. The tenders are equipped with water pick-up apparatus and have a capacity of 3,000 gallons, while six tons of coal are carried. The locomotives are equipped with the G.W.R. cab signalling apparatus.

S.R. Locomotive Works Re-organised

As a result of re-organisation, new engine construction is now carried out at Eastleigh and Ashford only; engine repairs are done at these two centres, while Brighton is used for light repairs only. Repairs to all bogie coaching stock are being carried out at Lancing, where such work is done on a modern and progressive system. New wagon construction and general repairs to wagons are being centralised at Ashford.

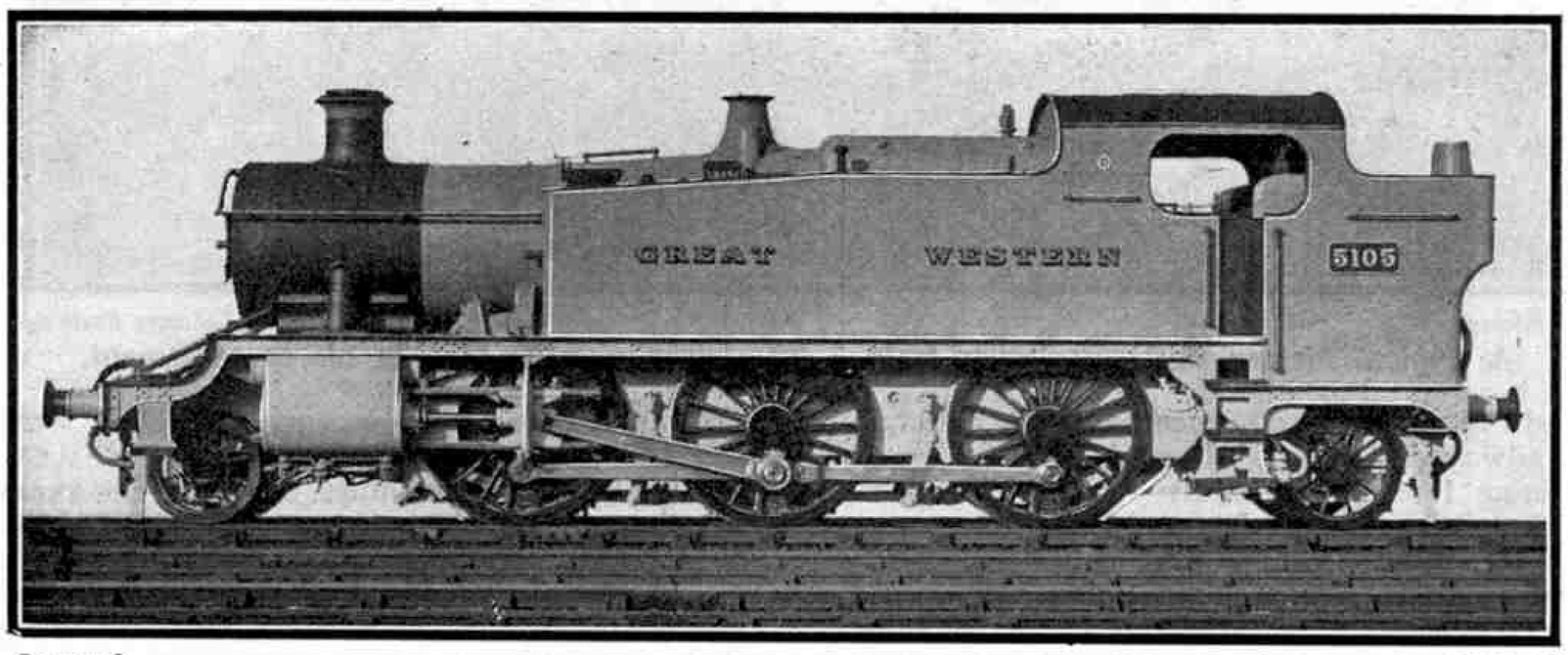
A new series of 20 three-cylinder 2–6–0 tender engines are now in hand at Eastleigh.

The Summer Holiday Rush

On 1st May, according to the railway calendar, the summer holiday season begins, and it continues until the end of October. Throughout this period, the activities of all the railways are vastly increased. Apart from those employed on the railways—few people realise the enormous proportions to which holiday traffic has attained.

Last year, in all, no less than 405,287,341 passengers were carried by the railways for day and half-day trips, period and tourist excursions and week-ends, representing an increase of 58,000,000 over 1928.

This year even greater things are expected and have been prepared for.



Courtesy] [*G.W.R.*

One of a series of handsome 2-6-2 tank engines now being constructed at Swindon. These are intended for mixed traffic working.

All through the winter, in office and in workshop, the best brains, brawn and machinery have been working at top speed to perfect this wonderful organisation. The time-tables are now prepared and every railway man and woman, from the highest to the lowest, knows exactly what his or her job is in the great "push."

There will be more fast expresses, better coaches and better services than ever before.

Tracks have been strengthened and improved, and hundreds of new express locomotives and corridor coaches built.

Signalling is constantly being overhauled in order to allow greater frequency of service. Numbers of large seaside stations have been rebuilt or enlarged to give better facilities for the volume of traffic anticipated.

New and capacious steamers will be introduced on the Continental and Channel Islands services. In fact, nothing has been over-looked in the desire to make holiday travel quick, convenient and comfortable.

Powerful 2–6–2 Tank Engines for G.W.R.

The lower illustration on this page shows one of a series of 2–6–2 tank engines now being constructed at Swindon. These are intended for employment as mixed traffic locomotives. Generally they resemble the engines of the No. 31xx type, differing in having outside steam pipes and in the position of the rear sandboxes. The footsteps at the leading end also are modified. The first of the series is No. 5101, and this was completed at the beginning of October last.

The cylinders are of standard pattern and have a diameter of 18 in. with a stroke of 30 in. The grate of the Belpaire firebox has an area of 20.35 ft. The heating surface of the firebox is 121.80 sq. ft. To this must be added 1,144·95 sq. ft. provided by the fire tubes and a further 82.20 sq. ft. given by the 36 tubes of the superheater making a total heating surface of 1,348·95 sq. ft. The working pressure is 200 lb. per sq. in.

The overall length of the new tank engine is 41 ft. The total weight is 78 tons 9 cwts. The coupled wheels have a diameter of 5 ft. 8 in. and the total adhesion weight is 52 tons 13 cwts.

Speeding-Up on the G.W.R.

The Great Western Railway has obtained the approval of Parliament for its scheme to construct a new line, two miles and five chains in length, in order to avoid a curve at Frome. It was stated that the deviation will mean a reduction of only 300 yards in distance, but there will be a saving in the time of the expresses to and from London of six minutes. It was calculated that the saving in coal in respect to passenger trains alone will amount to 370 tons a year. The diversion will cost £78,277.

Starting on 1st April, the G.W.R. has accelerated the service from the Channel Islands, the journey time between Jersey and London and other towns in this country being reduced by one hour.

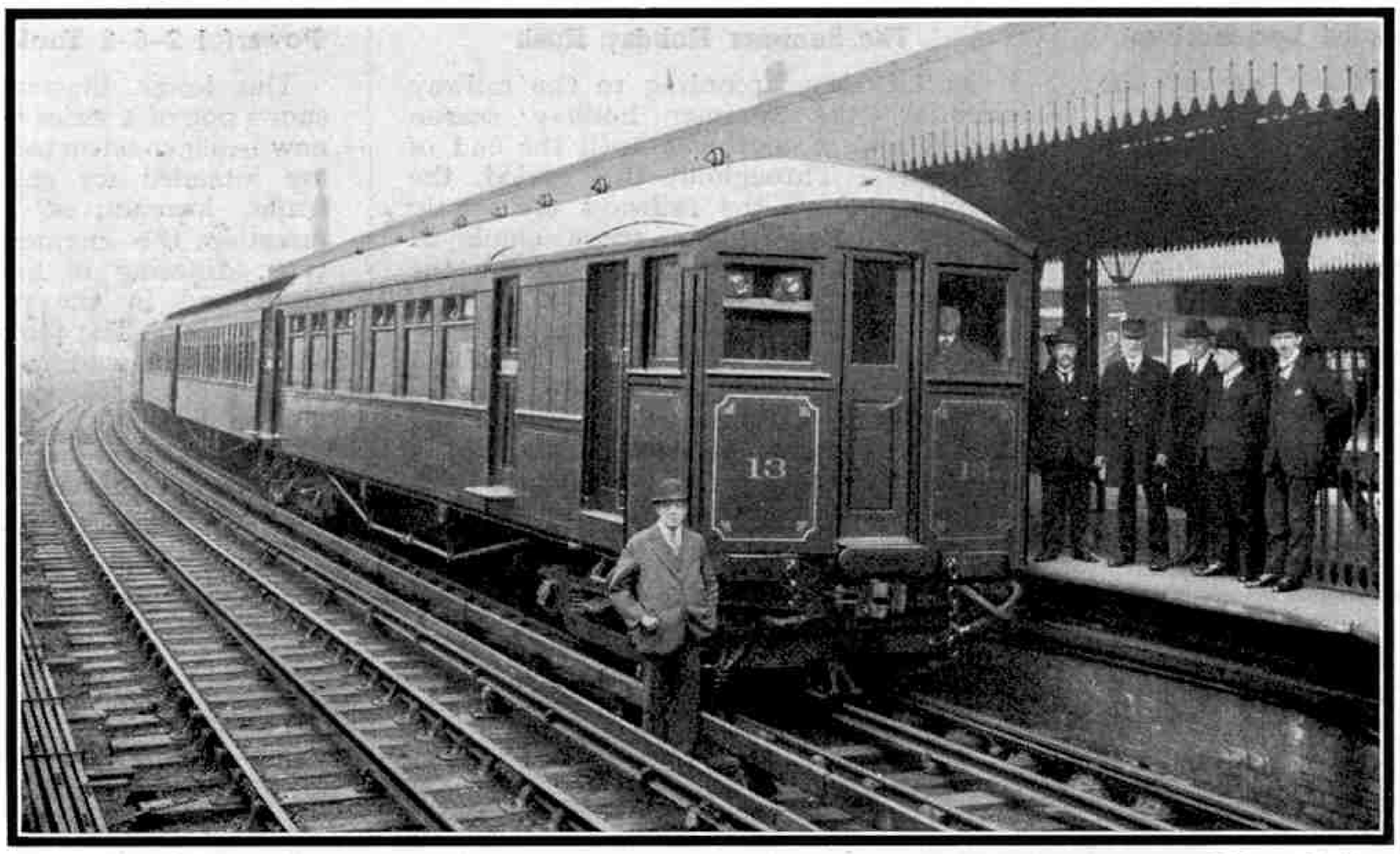
The Three Electric Railways of Liverpool

II.—The Mersey Railway

By R. D. Gauld, M.Eng., A.M.Inst.C.E.

LESS conspicuous than the Liverpool Overhead Railway with which we dealt last month, but equally interesting, is the Mersey Railway that connects Liverpool and Birkenhead by means of a tunnel beneath the River Mersey.

On the Liverpool side of the river the Mersey Railway has its own low level station situated beneath the Cheshire Lines Railways' Central Station, from which it is reached by stairs and subways. From this station, which is known as Liverpool Central Low Level, the railway proceeds underground in a double track tunnel to James Street Station in the shipping office district of the city. From there it falls steeply to pass under the river, which here is about a mile in width; and then rises again into the Birkenhead Station of Hamilton Square.



Courtesy [*Mersey Railway*

A Typical Mersey Railway electric train. The driver may be seen in his compartment.

Continuing west, the railway diverges. The right-hand portion goes to Birkenhead Park Station where a junction is effected with the L.M.S. system that serves New Brighton, Hoylake and West Kirby. At present the electric trains of the Mersey Railway do not go beyond Birkenhead Park Station, but the adjoining lines undoubtedly will be electrified before very long. The left-hand branch comes into the open just before reaching Birkenhead Central Station. From there it proceeds underground again to Green Lane Station and thence in the open to Rock Ferry where there are interchange facilities with the L.M.S. and G.W. joint line from Birkenhead to Chester.

The Mersey Tunnel Railway Company was formed in 1866, but work was not commenced until December 1879, the contractor then being Mr. John Waddell and the engineers Messrs. Douglas and Francis Fox and Sir John Brunlees. The first portion of the tunnel to be constructed was that between James Street and Birkenhead Central Stations.

It was expected that large quantities of water would have to be dealt with, both during and after construction, as for 1,320 yds. the tunnel is actually underneath the river. Strangely enough more water was met with under the land than under the river, and mostly on the Liverpool side. The smallest distance between the top of the tunnel arch and the bed of the river is 30 ft. and at high tide there is a depth of water of 100 ft. The tunnel passes through sandstone rock, and the comparative dryness under the river was thought by the engineers to be due to the sealing up of the fissures in the rock by fine silt and clay.

The tunnel is designed with a drainage heading from a shaft at each side of the river, rising up on a gradient of 1 in 500 to meet the lowest point of the tunnel beneath the river. These shafts subsequently became the pumping shafts, and the sinking of them was the first job to be undertaken. They are 1,770 yds. apart, the one on the Liverpool side being 15 ft. in diameter, while that on the Birkenhead side has a diameter of 17.5 ft. The shafts are 170 ft. in depth. From them the main tunnel was set out, and this was quite a problem because warehouses prevented a direct sight being taken between the two shafts. A base-line 8 ft. in length in each shaft was obtainable. When the headings met, 1,115 yds. from the Birkenhead side and 639 yds. from the Liverpool side, the error in both the line and the level was less than an inch.

By means of the drainage headings it was possible to drive small cross tunnels on to the line of the main tunnel, which thus could be constructed from several faces or "break-ups." At one time work was proceeding from no less than 24 faces at once. At the outset the driving from the Liverpool side was carried out by hand labour with drills and explosives, and an advance of 9 yds. for a six-day week was made. At the Birkenhead side the Beaumont drilling machine, then recently invented, was adopted, and from 34 to 65 yds. per week was accomplished. Owing to the frequent breakdown of the machines, however, the average process throughout the work was 9 yds. per week. "Tonite" was found to be the most suitable explosive, and it is recorded that on one occasion serious alarm was caused on a battleship in the river as the result of the sound of explosions coming from some mysterious source that was obviously under the water!

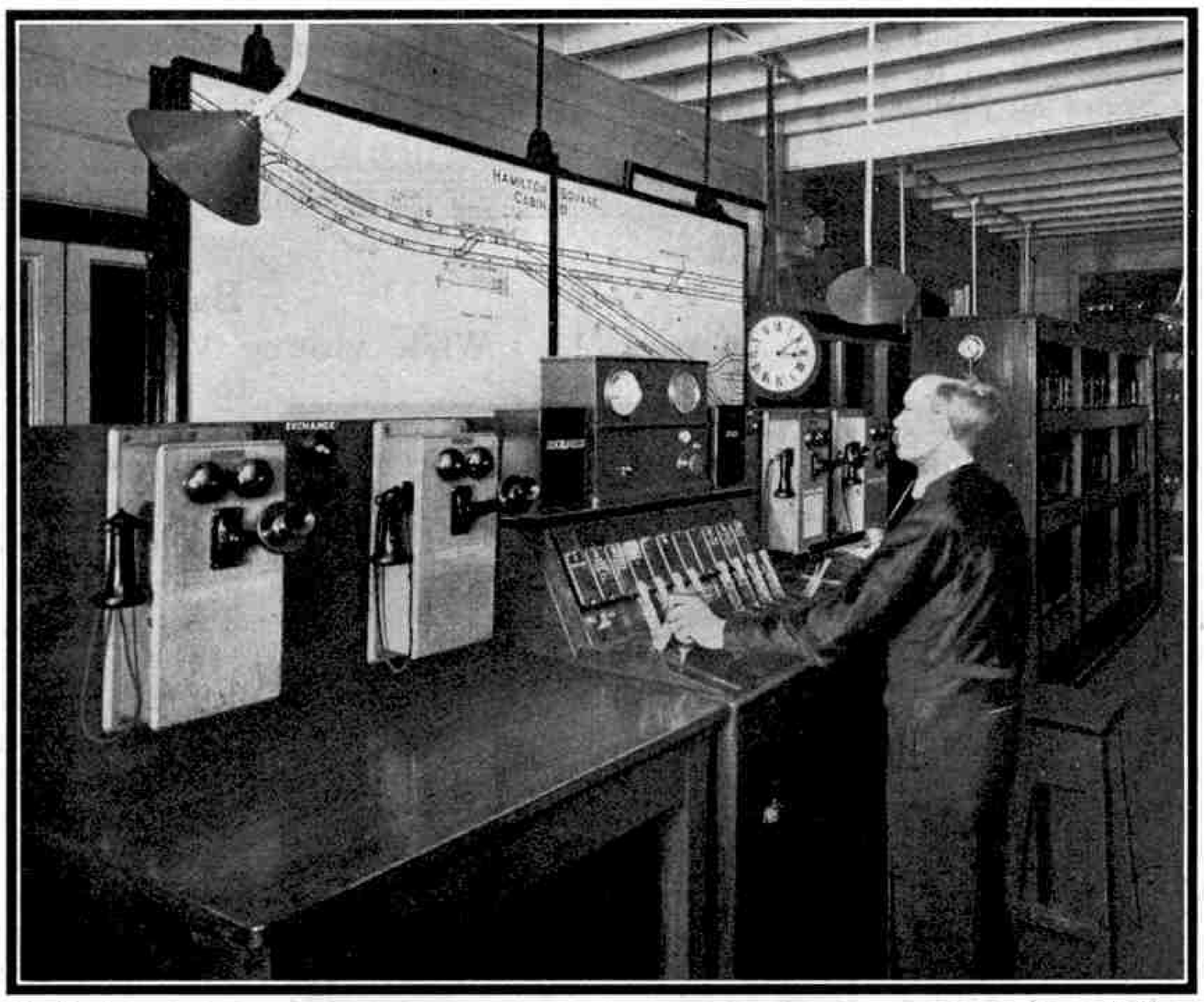
In the course of the work a total of 320,000 cu. yds. of rock were excavated. The tunnel is 26 ft. in width and is 19 ft. in height from the rails to the highest part of the roof. The brick lining varies according to the nature of the rock, but it is usually 18 in. in thickness. Altogether 38,000,000 bricks were used. A special type of construction was employed where the Mersey Railway passes under the L.M.S. and G.W. joint line in Birkenhead. Very powerful pumps were installed at the outset and no serious trouble from water has ever been experienced in the tunnel. Large quantities of water had to be pumped out, however, and in 1919 the average amount dealt with was 6,000 gallons per minute. If the pumps were to fail, the capacity of the drainage heading is such that it would take five hours for the water to rise to rail level, thus providing an adequate margin of safety.

Diagram showing the operation of the automatic points system at Liverpool Central.

The tunnel was opened by the late King Edward, then Prince of Wales, on 20th January, 1886, but traffic did not commence until the first of the following month. At first steam locomotives were used and elaborate arrangements for ventilation were made, fans 30 ft. and 40 ft. in diameter drawing out foul air at the rate of over 1,000,000 cu. ft. per minute. When electric working

was introduced in 1903, consequent on the equipping of the line by the Westinghouse Electric Company, the ventilation requirements were much reduced, with the result of a fall in the annual cost from £5,430 to £332.

The rails at James Street Station are 90 ft. below the level of the booking hall, and the corresponding depth at Hamilton Square is 100 ft. The stations are 400 ft. in length in tunnels of 27-in. arched brickwork, and are 50 ft. in width and 32 ft. in height. For such deep stations lifts are, of course, essential, and the original hydraulic lifts supplied by Easton and Anderson are still in use. The lift cages, 20 ft. in length, 17 ft. in width and 8 ft. 10 in. in height, of which there are three at Hamilton Square and three at James Street, are attached to direct-acting rams 18 in. in diameter. The stroke of these at James Street is 76 ft. 6 in., and 87 ft. 9 in. at Hamilton Square, and the sinking of the ram cylinders into solid rock was no easy task. At each of these stations there is a 10,000 gallon supply tank of water placed on the top of the buildings about 120 ft. above the pavement, to secure a reserve of water under a high head in the very unlikely event of failure of the lift pumps.

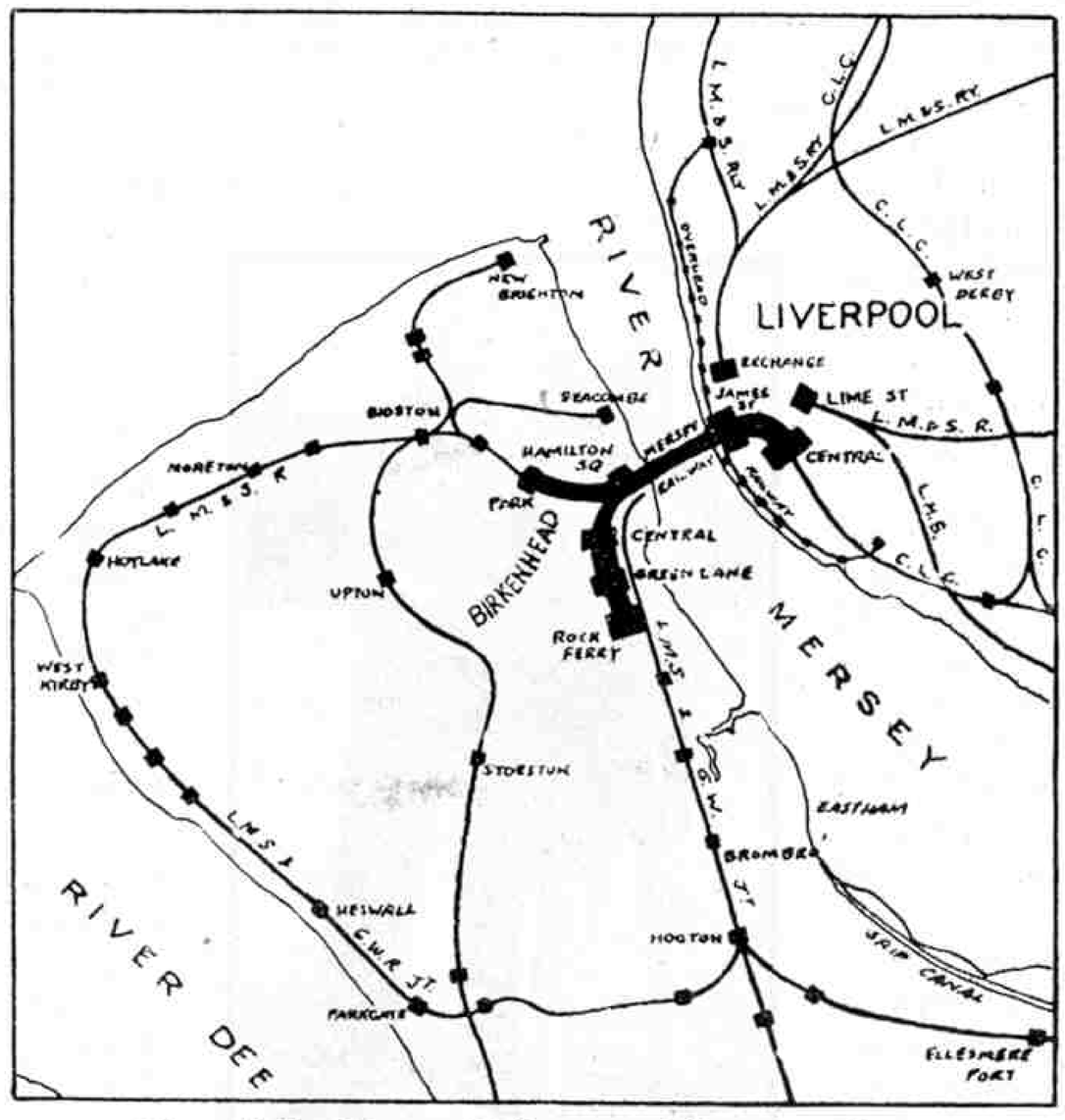


Courtesy] [*Mersey Railway*

Interior of the signal-cabin at Hamilton Square Station.

The inclusive cost of the Mersey Railway was about £737,000 per mile, and although it has never been a high dividend line its traffic has continued to increase steadily. In 1902, the last year of steam working, less than seven million passengers were carried. In 1928 the number was about 17 millions, and 464 trains per day were dealt with at Liverpool Central. At present the services are worked by 28 motor cars and 40 trailer cars, all of which are bogie vehicles of large capacity with centre gangway and end doors.

When the line was first opened, and for many years afterwards, it was signalled mechanically. This placed a very severe limit on the number of trains that could be dealt with, partly on account of the long section beneath the river, and partly due to the steep gradients, 1 in 27 and 1 in 30, leading under the river from James Street and Hamilton Square. In order to provide a better train service during the "rush hours" it was decided to adopt a system of automatic signalling, somewhat similar to that used on London's Underground Railways; and in 1922 the first section between Liverpool Central and Hamilton Square was brought into use. Train stops to apply the brakes to trains over-running stop signals are also employed, and illuminated train destination indicators are provided at the stations.



Plan of the Mersey Railway and its connections.

In 1925 the automatic signalling was greatly extended, being carried to Birkenhead Park on one branch and Green Lane on the other. But without doubt the most interesting feature of this work was the introduction of the automatic working of points at Liverpool Central. This was the first installation of its kind in the world, and it enabled a signal-box to be normally closed.

The operation of the system will be made clear by reference to the diagram on the opposite page. A train arriving from Birkenhead runs on to the piece of track CF, adjoining the platform, but it can only do this if the points at C are set for leading into the siding ED. After the lapse of a certain amount of time, actually about 25 seconds, and providing that siding AB is clear, points B and C automatically move over and the signal goes to clear to allow the train to pass into siding AB. As soon as it clears the points B, and a few seconds have elapsed, points B and C move back again, and the train, providing that section BG is clear, draws forward and loads up at the platform adjoining BG. When ready the train leaves for Birkenhead on the right line. Meanwhile another train can run on to track CF and be discharging its passengers at the platform. A more recent development is for the crossover FG to be worked automatically, so that if necessary trains can depart for Birkenhead from track CF, passing through the crossover FG. This plan greatly simplifies operations.

The enterprise of the Mersey Railway in adopting such up-to-date methods and in being actual pioneers in automatic point operation is highly commendable and is sure to be rewarded by a large increase in traffic.

One great drawback of the journey from Liverpool, via the Mersey Railway, to various parts of the Wirral Peninsula, is the necessity of changing from the electric to the steam trains. A glance at the accompanying plan, in which the route of the Mersey Railway is indicated by heavy black lines, will make this clear. For instance, a passenger wishing to travel from Liverpool Central to West Kirby may do so by either of two routes. He may go by electric train to Rock Ferry and change there into a steam train on the L.M.S. and G.W.R. Joint Railway, travelling via Hooton and along the coast line through Parkgate. Alternatively he may travel by electric railway to Birkenhead Park Station, and there change into a L.M.S. steam train, reaching West Kirby via Meols and Hoylake.

In either case the change from electric to steam or vice versa is inconvenient, and it is interesting to learn that there is a prospect of the electrification of the whole of the L.M.S. line from Birkenhead Park to West Kirby, and also the branch from Bidston to New Brighton. The short branch from Bidston to Seacombe is not at present included in the scheme, possibly because the L.N.E.R. have running powers over this section for trains on the old Great Central line to Chester and over the Dee to Wrexham and North Wales.

FROM OUR READERS

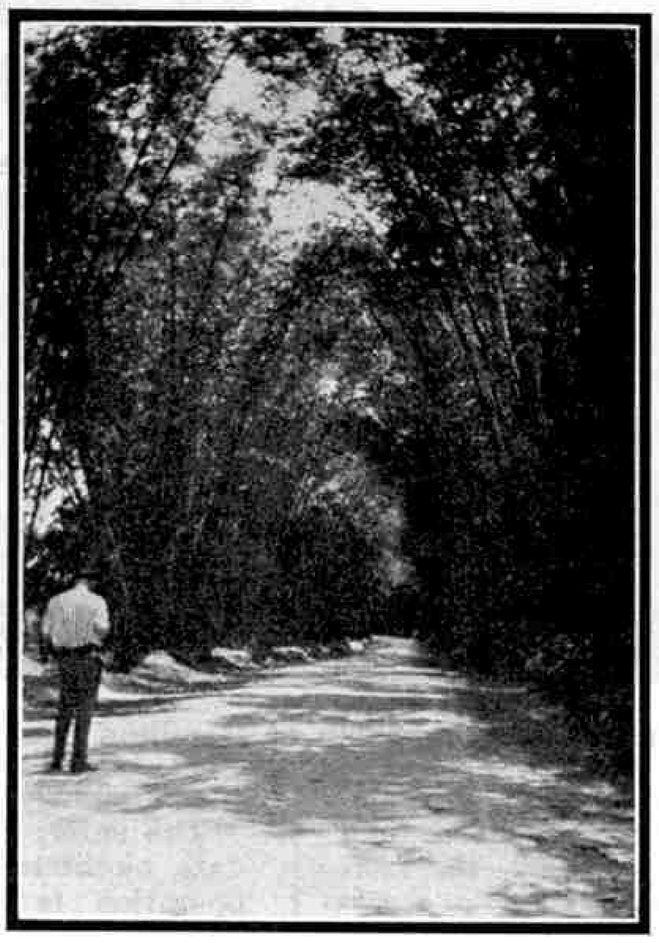
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Tall Hedge in Jamaica

I was greatly interested in the illustration on page 932 of the December, 1929, *"M.M."* of what is described as the *"World's Largest Hedge."* The accompanying photograph shows the bamboo hedges on the sides of a road in the parish of St. Elizabeth, Jamaica. These are not so tall as the Scottish example, but are interesting and well-grown hedges from 50 to 60 ft. in height.

The trees are not kept cut back, as is the case with the beech trees at Meiklour, and they form an arch that covers the road for a distance of practically a mile. The avenue is one of the show places of the island and during the winter months is visited by thousands of tourists from colder countries.

F. R. HENRIQUES (Jamaica).



Wonderful bamboo hedges in Jamaica. These reach a height of 60 ft.

Baby Seal as Pet

While visiting Vancouver I was fortunate enough to meet a real live baby seal. I first saw the creature while walking on the seashore in the early morning. He was lying on a swimming raft that I and my friend used and we quickly waded out in order to inspect him at close quarters.

The seal did not look particularly healthy and my friend and I came to the conclusion that he was sick and had been abandoned. But we took him ashore and gave him a good feed of warm milk in order to revive him. Later we built a pen in which we placed a tank of water. There he lived for some time and looking after him was a very interesting task. Unfortunately he did not thrive, however, and one morning was found dead. Examination showed that he had succumbed to an attack of pneumonia.

W. MCLEOD (Winnipeg).

Threatened by a Torpedo

The article on the Whitehead Torpedo that appeared in the *"M.M."* for February last reminded me of an unusual experience that I had some years ago at Weymouth. While fishing from the long stone pier I noticed that near the end of the Portland breakwater was a warship carrying out torpedo exercises. The courses followed by the torpedoes were plainly visible. They travelled in circles, sometimes on the surface of the water and at others nosing through the waves.

Suddenly one torpedo got out of its course and headed straight for the pier on which I was standing. Feeling slightly alarmed, I watched it coming nearer and eventually it crashed into rocks within a few feet of the pier itself. The impact dented it considerably, but the propeller at the back continued to run for quite a long time before slowing down and stopping.

At that time I did not know that practice torpedoes are not fitted with a warhead and contain no explosive charge. As the torpedo approached me, therefore, I had an uneasy feeling that the impact would cause a terrific explosion and in view of the destructive capabilities of torpedoes my thoughts may well be imagined!

A. L. JONES (Abergavenny).

Our reader, W. McLeod, holding a baby seal captured by him near Vancouver.

Tin Mining in Tasmania

For two years my father has been Chief Engineer of the "Pioneer" Tin Mine in Tasmania, and as a result I have become greatly interested in the operations carried on there. The tin is found 70 or 80 ft. below the surface of the earth and the earth containing it is washed out by water delivered from high-powered jets, the muddy liquid coming from the mine being delivered to the races on the surface by means of powerful pumps mounted on barges. There the heavy metal settles to the bottom, while the sand and rubbish are washed away, to be removed finally by means of a series of huge buckets that deposit it on a conveyer. Washing away the sand and earth in this manner is the most economical method of tin mining.

The crude tin remaining in the race is sent to Launceston, Tasmania, in order to be smelted. Tin smelted at this place is valued highly, and buyers in Great Britain readily give £5 per ton extra for it. Much of this high quality metal comes from the Pioneer mine.

J. GILBERT (Tasmania).

The Solway Viaduct

The Solway Viaduct connects Seafield, Annan, in Scotland, with Bowness on the southern shore of the Solway Firth. This old railway bridge is chiefly of interest on account of its length, which is considerably more than a mile. Its construction was commenced in 1865, and the official opening for both passenger and merchandise traffic took place in 1869.

The steelwork of the viaduct is supported on piers of light construction and only comparatively small loads could be taken across it. In addition, the violence of the gales that sweep up the Firth occasionally made it necessary to stop all traffic in order to avoid the risk of trains being blown over the parapet. At times danger threatened from ice, and at the end of the exceptionally severe frost of 1881, heavy floes descending the Firth carried away several piers, leaving a wide gap in the middle of the viaduct.

The Solway Viaduct is more than a mile in length and is one of the longest structures of its kind in this country.

After this mishap the line was closed for three years, but eventually it was decided that it was worth while making the necessary repairs. On the reconstructed bridge traffic then ran as usual until 1920. In that year the viaduct was condemned as unsafe, and since then no trains have passed across it. For some time afterward foot passengers desiring to cross the Firth made use of the structure, but this practice recently has been forbidden, and thus the useful career of one of the longest railway viaducts in Great Britain has come to an end. It is reported that the disused structure is now to be demolished.

L. COWELL (Annan).

The Peregrine Falcon

The heather-clad moorland was bathed in bright sunshine. Grouse and pheasants were busily engaged preening their feathers. The sun's rays enhanced the gorgeous colouring of the male pheasant's plumage. Far above this peaceful scene hovered a mere speck in the sky. In appearance this was harmless to anyone looking up from the moor, unless they had learned to recognise the form of the Peregrine Falcon, one of the most greatly feared of British birds. Up it soared to a height at which it was almost invisible to the naked eye; then like a thunderbolt it shot down upon the peaceful game birds in the heather.

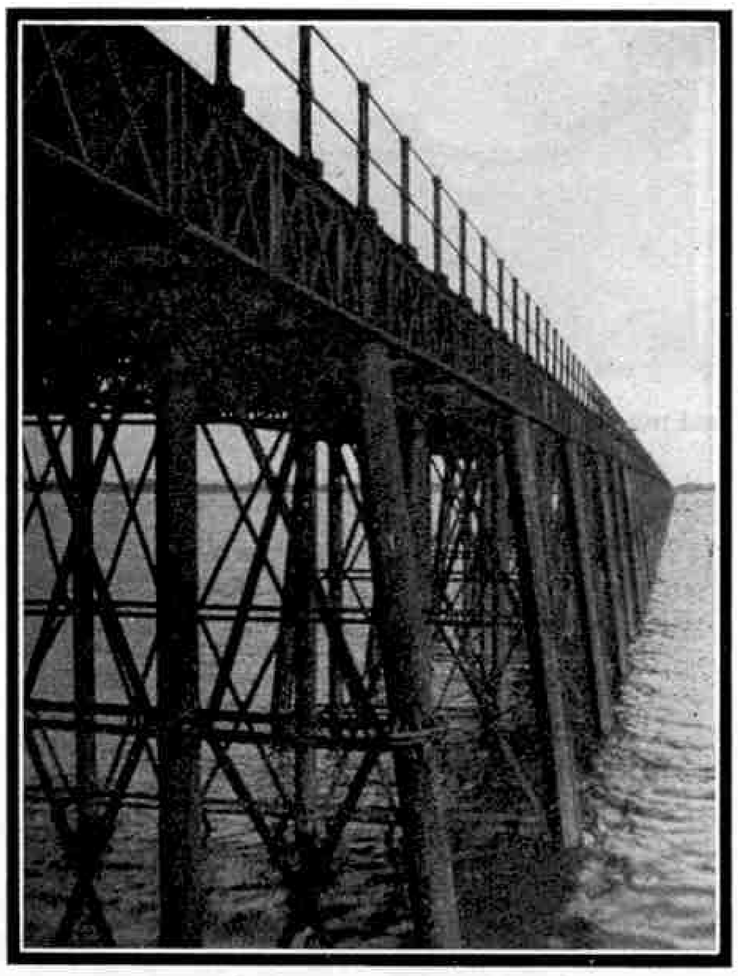
In an instant all was commotion. The male pheasant's warning cry rang out, and the sharp cry of the cock grouse added to the alarm of the terrified hens. The warnings were in vain, however, for the Peregrine swooped on his intended victims and struck them death-dealing blows with the razor-like spurs that every bird, large or small, has good reason to fear.

Such incidents as these are everyday tragedies on the moors. It is not every Peregrine Falcon that preys on game birds, but gamekeepers and trappers take no risks, and when their eyries are discovered the birds are ruthlessly destroyed. There may be justification for this. In a Perthshire glen I have seen Peregrines launch themselves from the precipitous crags on which they nested upon every bird that happened to come within their domain, sending their victims to the ground in a mass of bloodstained feathers. This was not done for the purpose of obtaining a meal, but only for the pleasure that these birds seem to derive from killing.

The usual haunts of the Peregrine are high cliffs bordering the sea, mountains or glens where food is abundant, and they often frequent woods on the outskirts of cities and villages. The nesting period is from April to June, and the most ardent egg collector thinks twice before venturing to climb to the high and most inaccessible ledge where the bird makes its nest. The eggs are four in number and have a very handsome appearance. They are reddish brown and are closely speckled and blotched with darker shades. During the first few weeks of their lives the chicks are covered with the white down that is characteristic of infant birds of prey. At the end of that period they cast it off and don the magnificent plumage that distinguishes the Falcon.

Owing to the operation of the Wild Birds Protection Act the Peregrine Falcon is increasing in numbers, but nevertheless it suffers greatly from the gamekeeper's enmity, and the greed of the egg collector.

J. KENNY (Glasgow).



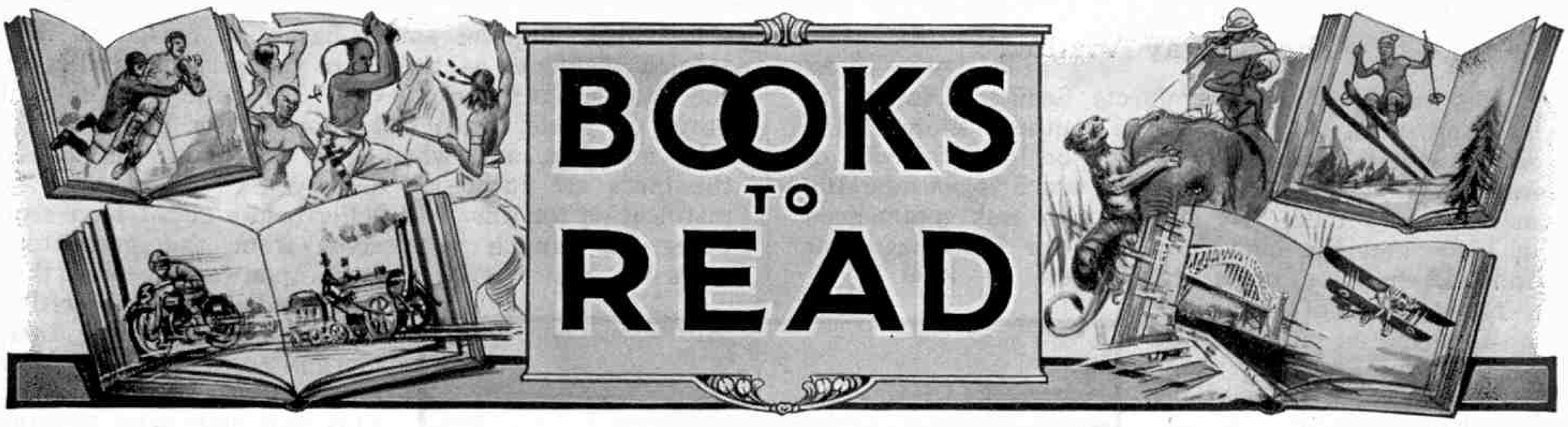
The piers of the Solway Viaduct are of light construction and on one occasion several were broken by ice floes.

Making a New Ice Surface

Recently I paid a visit to a London ice rink while the surface was being renewed. This was done by hand, the operation being completed in less than an hour by eight men.

The ice was first scraped in order to eliminate the scratches made by skates. After sweeping off the material removed in this manner the surface of the rink was watered by means of a hose pipe at the end of which was a fine rose. As the water fell the ice became as smooth as a sheet of glass and the lights were reflected in it as if it were a mirror.

I was informed that the ice is three in. in thickness. It rests on a bed of concrete in which are embedded miles of iron pipes and through these brine at a temperature below freezing point is continuously pumped. The refrigerating machine that cools the brine is installed in the cellar underneath the rink. A new ice surface is provided three times daily. C. F. GRAHAM (Erith).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/– should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"Ur of the Chaldees"

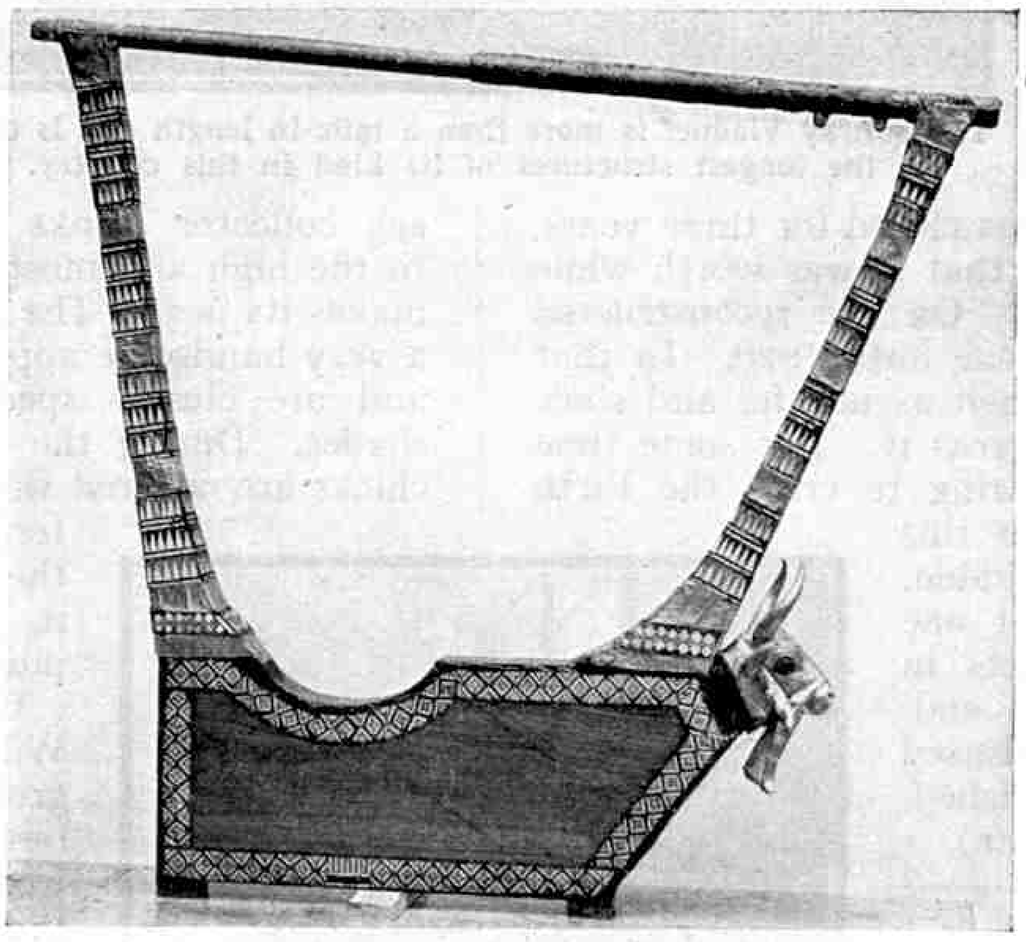
By C. L. Woolley
(Ernest Benn Ltd. 7/6)

This book is a popular account of the romantic and historically-important discoveries made on the site of the City of Abraham by the Anglo-American Expedition. Mr. C. Leonard Woolley, the author, was the head of the expedition, and although most people have heard about the excavations (and particularly of those at Ur of the Chaldees), few people know much about the wonderful work that has been going on there.

This book is intended to give information in a general way and it describes the excavations as a whole in a simple and readable manner. Only the more important results of the excavations at Ur are described, the technical aspects of the work have been omitted altogether. More attention has been paid to individual objects and to the manner of their discovery than to the historical conclusions that may be based on them. The objects and the buildings brought to light during the seven years just passed are dealt with in historical order, as far as is possible, because only so can they be seen in true perspective. The book is in no sense a history of the Sumerian people or of the city of Ur, but an account of the excavations that are helping to make that history possible.

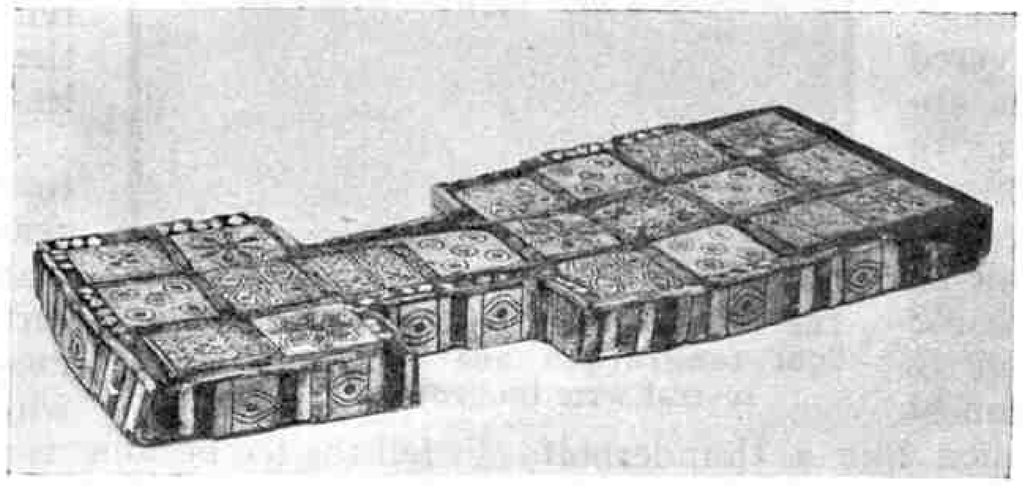
Mr. Woolley's story is a fascinating one. First he tells us about the discovery made last winter of material evidence for the Flood, and for the culture that preceded that disaster in southern Mesopotamia. Then comes an account of the early cemetery, including the now famous Royal Tombs, the treasures from which have revolutionised our ideas of the beginnings of western civilisation. Next are described the ruins of the time of the Third Dynasty, when Ur was an imperial city and its finest buildings were erected, and so on until the latter days, when the sister of Belshazzar was High Priestess of the Moon-God and Cyrus, King of Persia, restored for the last time the age-old monuments of the holy city.

Few excavations have produced in so short a space so continuous a record of civilisation, and for some of the periods the only evidence that we possess comes from the ruins of Ur. But if it is as historical documents that the objects there unearthed gain most in interest their artistic appeal is scarcely any the less insistent.



A gold and mosaic Harp taken from the Great Death Pit at Ur (see below).

One of the most interesting portions of the book is that in which Mr. Woolley describes how he dug down to a great bank of clay, 8 ft. in thickness, that could only have been deposited by a flood of enormous magnitude. Beneath this he was astonished to find the flints and coloured pottery of a highly civilised race. He realised at once that he had discovered evidence of the Flood described so vividly in the Book of Genesis.



An inlaid Gaming Board. One of the illustrations from "Ur of the Chaldees" reviewed on this page.

"Articulated Locomotives"

L. Wiener. (Constable. 42/–)

Professor Wiener has given us a masterly review of this special class of locomotives, which are used mostly on colonial and overseas railways. He has tried to establish a clear system of classification of the numerous types, stating his facts methodically so as to facilitate reference and avoid confusion.

The volume is divided into four books, which deal respectively with articulated locomotives properly so-called; semi-articulated locomotives; temporarily articulated locomotives, or locomotives with auxiliary engines; and the utilisation of the weight of the tender for propulsion. The books again are divided into numerous parts, fully classifying all the different locomotives that fall under the various heads. There are many illustrations both in half-tone and line, and although separate indexes fill the want to a certain extent the book lacks a comprehensive index.

Although the author does not describe articulated locomotives in chronological order, an appendix gives the sequence of the invention and progress of this type of locomotive. We learn that the first articulated locomotive was invented by Horatio Allen in 1832, and was built by the West Point Foundry for the South Caroline Railroad. Two years later Miller patented a system for transferring part of the weight of the tender to the locomotive, and this system was applied by Baldwin to locomotives for the Philadelphia and Trenton Railroad.

In 1863, Robert Fairlie patented his articulated locomotive with either a simple or a double boiler, and this type was used for many years, a large Fairlie locomotive "*Progress*" being built in 1865 by Cross and Co., for the Neath and Brecon Railway. The first single Fairlie locomotive was built about 1869 for the Great Southern and Western Railway of Ireland.

The first Mallet locomotive, "*L'Avenir*," was built in 1887 by the Société Métallurgique in Belgium. It was tried on the Military Railways of Tôul, later at Laon, and in 1889 was placed in regular service on the Paris Exhibition Railway, since which time thousands of Mallets have been used in different parts of the world. The first standard gauge Mallet was built in 1890 for the St. Gothard Railway and at the time was the most powerful locomotive in Europe.

The first Garratt simple locomotive

was built in 1911 by Beyer Peacock and Co. Ltd., for the Darjeeling and Himalayan Railway, and an eight-cylinder Garratt was built the following year for the Tasmanian Government Railways. The first Garratt locomotive used in England was built in 1923 and patents were taken out by Beyer Peacock & Co., about 1924 for Mallet—Garratts, and Turbine Garratts.

"From the Ivory Coast to the Cameroons"

By A. J. Reynolds
(A. A. Knopf. 12/6)

Those fond of travel and adventure will find much informative reading in this book, in which the author not only shows a keen appreciation of the beauties of Nature but adds much to our knowledge of birds, beasts, and fishes, trees and flowers, as well as of native types. The book, which is very readable and contains many interesting and amusing stories, takes the reader from Sierra Leone to Kumasi and into the interior; then to Axim and inland to Akim, through the Great Ashanti Forest; back to Cape Coast Castle and after various adventures to Accra, where we learn something of the cocoa and cotton industries of the Gold Coast Colony. In the final chapters we are told the thrilling story of the conquest of Togaland and of the Cameroons.

One of the illustrations that we publish on this page shows a preliminary scene to the interesting custom of "stooling" a West African Chief—in this case his name was Kuwaku Boateng. Every subordinate chief from the surrounding district came to the ceremony accompanied by his State Umbrella Bearers. The umbrellas were immense, some being 12 ft. in diameter, gaily coloured and tasselled. On the various routes that led to the ceremony there was an incessant drumming accompanied by the "music" of the native musicians' flageolettes, pipes and horns. The tap of a drum was enough to make the whole party shout and dance like madmen!

When the chief approached the place for the ceremony, he dismounted from his hammock, which was covered by an immense coloured umbrella. His mother, who came to the ceremony clothed in a man's waistcoat from which the pockets had been cut, dealt very promptly with an old chief from an outlying district. Whilst the palaver was at its height, this old chief created some commotion that was not on the programme. With one cuff from her huge hand the queen-mother laid him flat, and "before he could recover she stamped on his head with a foot as large as a shoulder of mutton! . . . Guns were going off without cessation. As different chiefs approached, the noise was deafening. Each chief was saluted with a terrific crash of gunpowder. The drums were carried on men's heads and the beaters walked behind, crashing away at their instruments. . . . Dancers accompanied each chief . . . in giddy swaying circles round the drums.

"When all were present the chief was invited by the Commissioner to take the stool, but before he was allowed to do so the queen-mother had a word to say and apparently it took her about an hour to say it!" When she had finished, the chief was seized by the five subordinate chiefs who took hold of whatever portion of his body came handiest and with extraordinary gentleness conducted him to the golden stool of his father, and with see-saw motion raised and lowered him five times. When he had been placed on the stool for the fifth time he rose of his own accord and immediately some of his attendants seized the stool and darted away with it, this being part of the ceremony based on an historical legend. The ceremony of "stooling" was over, except for rejoicings that were carried on until evening, with native dancing and general celebrations.

Visitors for the "Stooling" of Kuwaku Boateng arriving from the outlying villages under his rule. They came accompanied by native musicians and drum beaters (see below).

On the Afram River, Eastern Province. The illustration shows ceremonial barges of a chief from the northern territories. (Both the above illustrations are from the book "From the Ivory Coast to the Cameroons" reviewed on this page).

"The Boys' Book of Cricket"

By F. A. H. Henley. (G. Bell & Sons Ltd. 3/6)

It is easy for anyone who has played a particular game for a few years to write a book about it containing sound general advice that nobody can quarrel with, and yet having no practical value because it contains little else but generalities. Mr. Henley has achieved the difficult task of writing a book that contains few generalities, but is packed with practical advice. It is certainly the best boys' book of cricket we have seen.

The author adopts the modern scientific method of teaching largely by means of action photographs. He deals first of all with the correct method of holding the bat, and passes on to show by word and picture exactly how different types of strokes must be played if they are to be successful. An interesting feature of the illustrations is the chalk lines that are shown drawn at right-angles to the stumps in order to demonstrate exactly the position in which the feet should be placed. The chapters on bowling are clearly and concisely written, and one only regrets that the author was not able to include a larger number of photographs in this section. It is obvious that bowling methods are more difficult to illustrate than batting strokes, but we think that more might have been done in this direction. The advice given on equipment is thoroughly practical, and we are glad to see that the author emphasises the necessity of wearing gloves at practice. The importance of "kit inspection" before a match is illustrated by a reference to the victory of Cambridge in the University match of 1905, which was almost certainly the result of Oxford's best bowler bursting a shoe and having to bowl in an ill-fitting borrowed pair.

The book concludes with a chapter entitled "Do's and Don'ts," and we agree with Mr. P. F. Warner, when, in a foreword, he says that this "might with advantage be framed and hung on the wall of every cricket pavilion throughout the British Empire."

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"Hobbies for Girls"
by Mabel K. Gibbard
(Sampson Low, Marston Co. Ltd. 6/-)

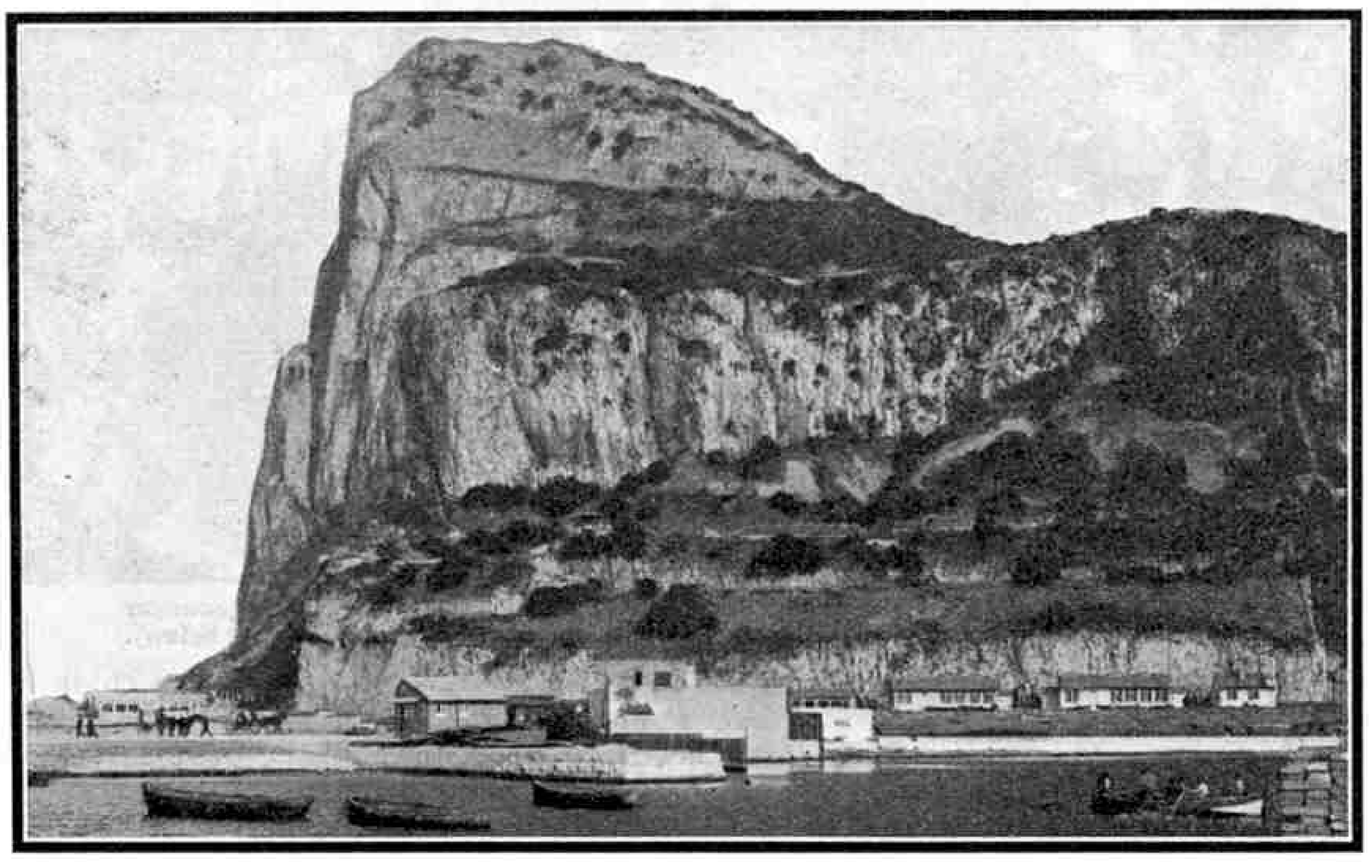
"Hobbies for Boys"
by G. Gibbard Jackson
(Sampson Low, Marston Co. Ltd. 6/-)

Linking Up Two Continents

Proposed Railway Under Straits of Gibraltar

By R. D. Gauld, M. Eng., A.M.Inst.C.E.

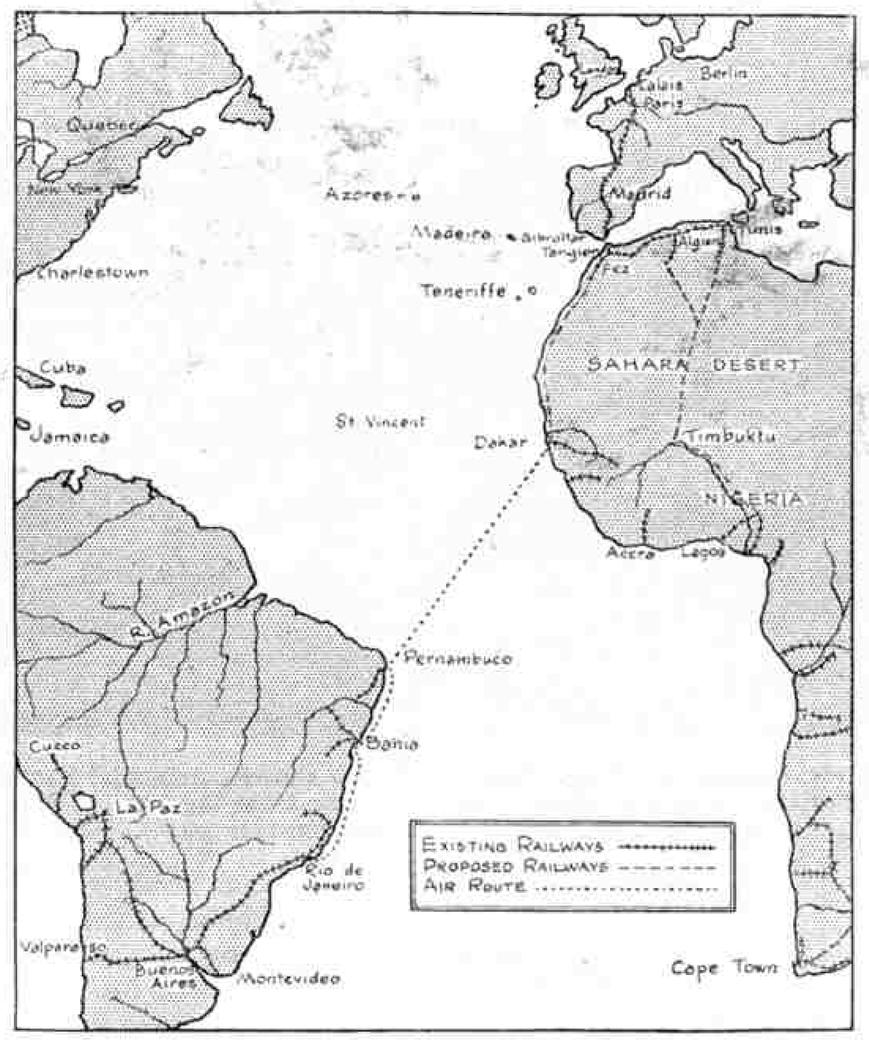
THERE seems to be something peculiarly fascinating about submarine tunnel schemes. Their possibilities are certainly far-reaching, more so indeed than appears at first sight. Take, for example, the proposed tunnel beneath the English Channel. The obvious advantage such a tunnel would give is of course that of providing rapid communication between England and France and Europe generally; but beyond this a little consideration will show that the tunnel would also bring Siberia and the Far East into direct communication with Great Britain. A tunnel passing under the Straits of Gibraltar would provide a link with Africa, and one beneath the Bosporus would extend direct travel facilities to Southern Asia, including India. Even this does not exhaust the possibilities, for America, too, could be linked up by way of a tunnel under the Bering Straits, which are only 36 miles in width at their narrowest point. The engineering problem involved in these schemes are admittedly serious, but even the last-named scheme, fantastic as it may seem, is by no means impossible.



Gibraltar, the starting point of the proposed submarine tunnel to Tangier.

The scheme for a tunnel beneath the English Channel has passed through many vicissitudes since it was first put forward some 130 years ago, and the fact that it has persisted all this time affords ample proof that the idea has a sound and practical basis. The objections that have hindered the progress of the scheme have arisen mainly from the military and naval authorities. When the sinking of experimental shafts was commenced near Dover, and at Sangatte in France, in 1881, the military authorities suddenly woke up to the significance of the work and opposed the scheme tooth and nail. Their objections had a basis of reason, but they exaggerated matters to an absurd extent.

On one occasion Lord Wolseley declared that "Dover in the possession of an enemy holding the tunnel, means England is at its mercy." Admiral Sir Cooper Key, First Sea Lord of the Admiralty, was equally emphatic. He expressed the opinion that "four hours' possession of the tunnel would enable 100,000 men to assemble, and they would be joined in as many hours by as many more. What is to prevent an army from marching on London while our Navy, in all its pride and strength and power, looks on, a helpless spectator?" These objections had great weight at the time, but to-day they have lost their force, and the only serious obstacles to the Channel tunnel appear to be economic. Whether the tunnel ever becomes a reality or not, it may at least be said that the preliminary borings and other investigations that have been made suggest that from an engineering point of view there are no insuperable difficulties.

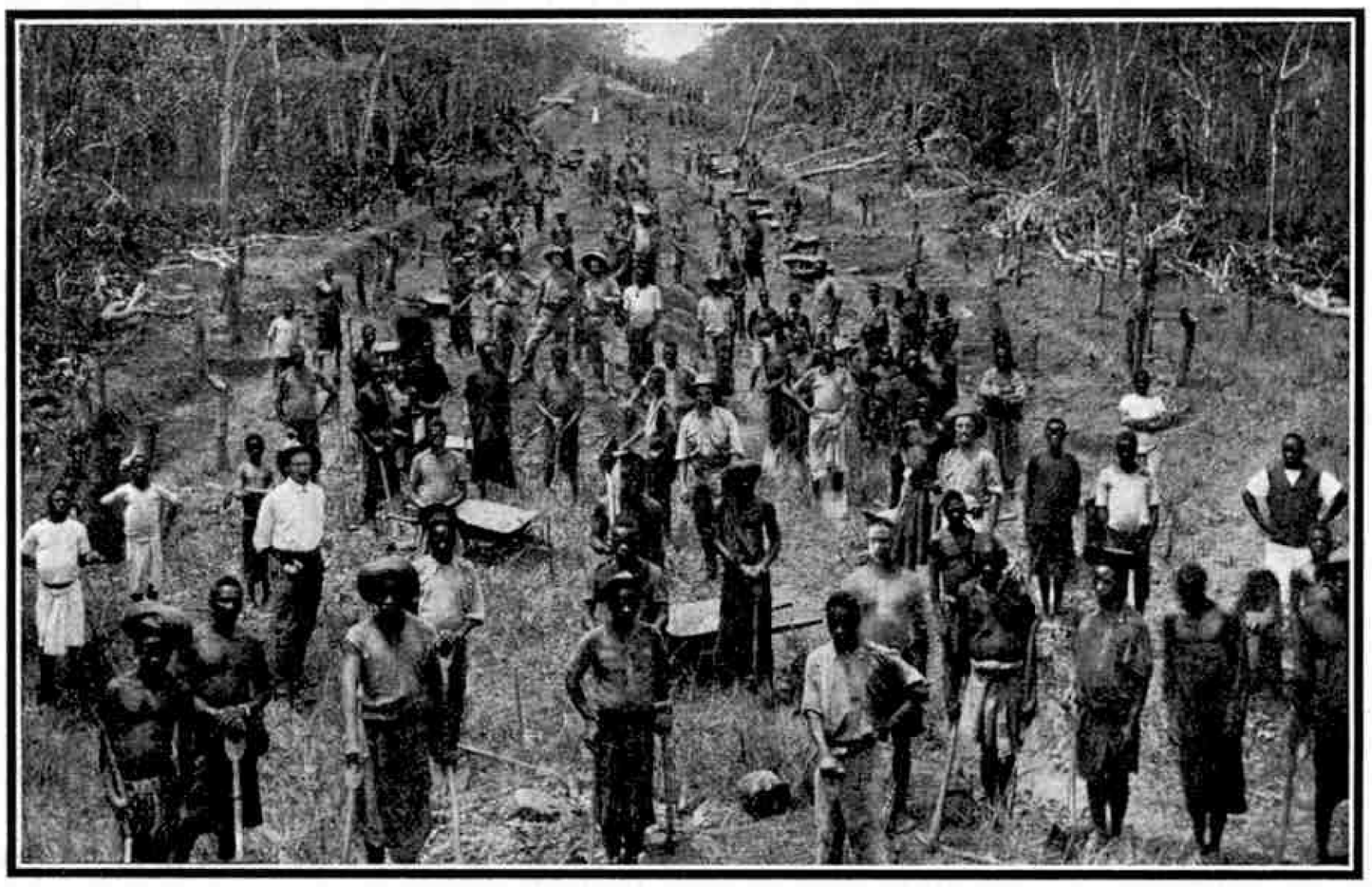


Sketch map showing how a tunnel from Gibraltar to Tangier, coupled with a railway across the Sahara Desert and the air route from Dakar, would shorten the journey from Europe to South America.

It is natural that the idea of a tunnel should occur sooner or later in connection with any narrow strip of water that carries heavy traffic, and therefore it is not surprising that a scheme has been put forward to bore a tunnel beneath the Straits of Gibraltar. This project is of great importance not only to Spain, and to France as one of the chief territorial powers in Africa, but to Europe in general, and indeed the whole world. It would permit the establishment of easier and more rapid communication by rail between Spain and Africa, and hence a great improvement in the access to Central Africa and even to South America. The first really well-thought-out scheme for such a tunnel was put forward by Sr. Ibañez de Ibero, who has studied the problem minutely in all its

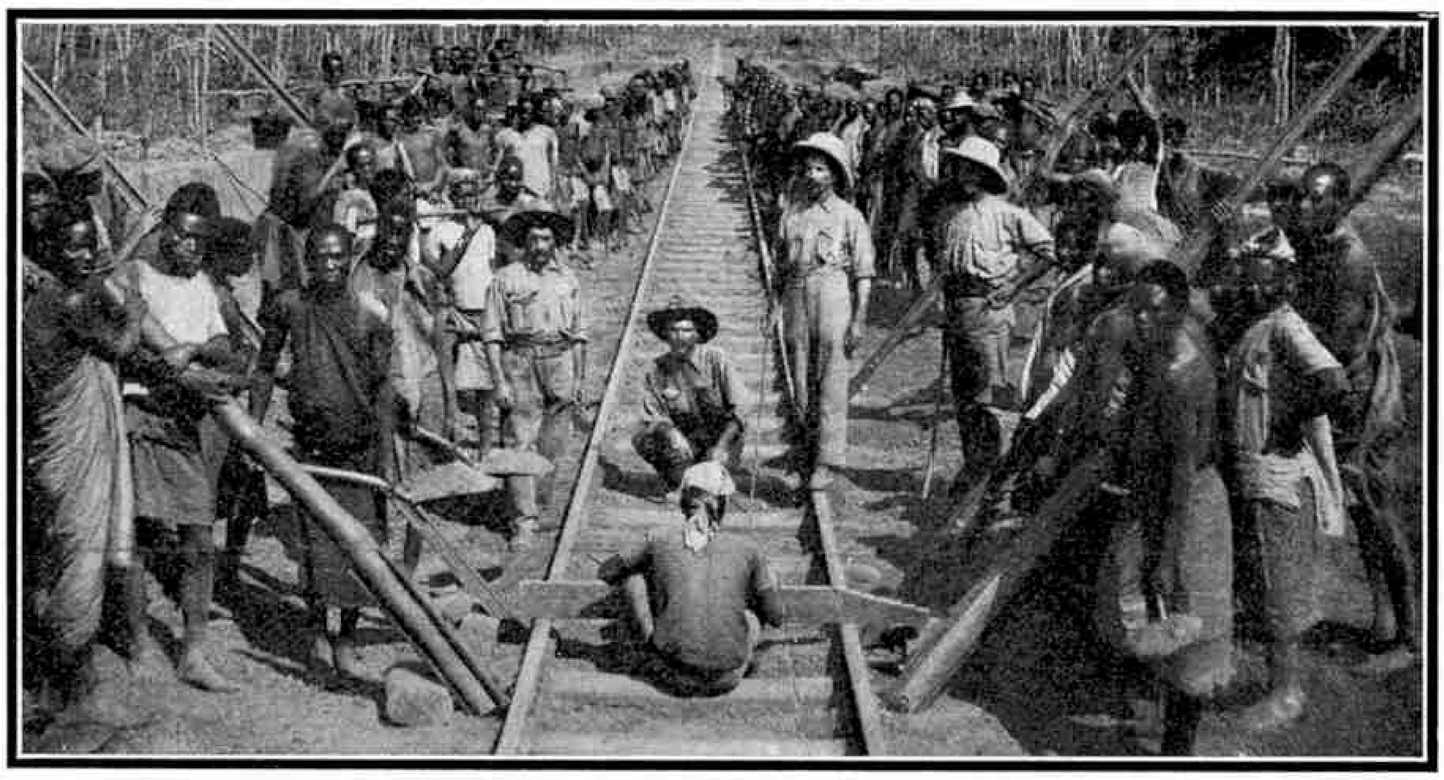
aspects. An interesting account of the Spaniard's scheme, written by a French expert, appeared some time ago in "*La Science et la Vie*," and to this we are largely indebted for the details in our account of this important intercontinental transport link.

Dakar is the last port of call for ships sailing to South American ports such as Pernambuco, Rio de Janeiro, Montevideo and Buenos Aires. From Dakar to Pernambuco, the nearest port, is 1,981 miles, while from Pernambuco to Marseilles the distance is 4,441 miles and to Bordeaux 4,419 miles. A railway traversing Gibraltar Straits, and aircraft for the ocean crossing, would enable the journey from Paris to Rio to be made in six days; from Paris to Montevideo in seven days; to Buenos Aires in eight days, and to Santiago, via the Transandine Railway between Argentine and Chile, in nine days, without change of vehicle between Paris and Dakar, the departure point for the aerial crossing of the ocean. With connections to the Cape to Cairo and the Trans-Saharan lines, which form the skeleton of a system extending to all the most promising parts of Africa, this new commercial route would serve to join up Europe, Asia and Oceania. Nearer home, Morocco offers great opportunities for development in many directions.



Piercing Africa by rail; natives clearing a way through the forest.

The project of a railway linking up the continents is not new. In 1917, M. Ch. Lallemand, in a communication to the "*Academie des Sciences*," said: "By its position, which makes it a hyphen between Europe and Asia, Spain seems destined to fill, some day, when the Dark Continent becomes more developed, the role at one time played by Constantinople—a kind of bridge between Europe and Asia." Sr. Ibañez de Ibero, following several memoirs on the subject, presented the main outlines of his proposal before the "*Academie des Sciences*" on 25th July, 1927.



The track grows mile by mile.

In contrast to the Straits of Dover, which were formed by the slow eroding process of the waters of the English Channel and the North Sea, the Straits of Gibraltar are the result of some sudden earth movement. The Calais and Dover shores slope down gradually to give a maximum water depth of 216 ft., while at Gibraltar there is a depth of 3,280 ft., which occurs at the eastern end of the Straits, between Guadalmesi Point on the Spanish side and Cires Point on the African shore. On the other hand, a line drawn from Naqueros Bay, to the West of Tariffe, to Tangier, would encounter much smaller depths, 1,300 ft. being the maximum. Between Cape Trafalgar and Malabata Point the depths would be as small as 1,020 ft., but the length of this route, 33 miles, would be too great. The Tangier route, with a length of 30 miles, of which 20 miles would be under the sea and 10 miles in the approaches, is the one considered most practicable. Tangier is an international town, however, and in consequence difficulties arise. To avoid these it is proposed to divert the line of the tunnel, if necessary, to allow the African end of it to be in Spanish territory.

Neither the length nor the anticipated depth of the work presents any insuperable obstacle. Although there is no precedent for a tunnel of this length, we know that in the tin and copper mines of Cornwall there are headings that extend farther than this, and show no sign of infiltration. The St. Gothard Tunnel, 4,100 ft. beneath the mountains, and the Simplon Tunnel, in places 8,200 ft. below the surface, show the possibility of work at greater depths than would be met with here.

The author of the project proposes to construct the tunnel from three galleries. First of all an auxiliary gallery about 10 ft. in diameter would be driven at a slightly lower level than the main tunnel, and would be used to facilitate the construction of the latter. As this gallery advanced, cross galleries would be driven towards the axis of the tunnel, there again giving access to headings which would be enlarged into two galleries, together forming the main tunnel. This method would also make easier the removal of water and the excavated material from the workings.

The twin galleries would each accommodate one track. They would be circular—of about 16 ft. 6 in. diameter—and connected at intervals by cross tunnels. The spoil would be removed by the most up-to-date methods, the

material being made into "slurry" by mixing it with water, and then disposed of by pumping.

Various ventilation schemes might be adopted. In the San Francisco tunnel the cross section is a circle divided into three compartments by horizontal partitions. The upper one permits the removal of foul air, while the lower one supplies fresh air, admitted at numerous places along the length of the roadway. A similar scheme was adopted in the New York-New Jersey tunnel.

Construction being finished, the double track would be electrified. The catchment area of the Guadalquivir is capable of supplying 200,000 h.p., and could easily provide the necessary motive power. The passage of the tunnel would be made in half-an-hour, instead of the customary three hours by sea.

The estimated cost of a huge undertaking of this kind is naturally of paramount importance. If 1,000 men were employed on the work it is believed that this could be completed in from five to six years, and the author of the project estimates that the total cost would not exceed £12,375,000. Of this, £937,500 would go to preliminary works; £7,200,000 to the submarine tunnel; £3,037,500 for the portion of the works not under the sea, and £1,200,000 for contingencies. The amount of traffic that would be available cannot, of course, be estimated with certainty, but the author gives good reasons for his belief that the financial soundness of the scheme is beyond doubt.

Mechanical Fingers made from Meccano

(*Continued from page 389*)

distance between the chucks is thus increased, the pulling out of the softened tube being accomplished in exactly the same manner as if the tubing were held in the operator's hands, the Angle Girders and chucks thus acting as efficient substitutes for fingers.

Occasionally the shape or size of the end that has been melted prevents it from fitting into the needle. This can be quite easily corrected by an experienced glass blower, either by carefully re-heating in one spot to alter the shape, or by fusing another piece of tubing on the end and repeating the entire operation. The framework carrying the gas burner is left with a little side play so that the flame may be moved sideways when necessary to re-heat the ends of the capillary tube before removal from the chucks.

This apparatus works very effectively, and its inventor is to be congratulated upon his ingenuity. At the same time, the mechanism affords another striking example of the remarkable adaptability of Meccano.

A New British Roll Film

An event of great interest to photographers is the appearance this month of a new British roll film. This film has been given the name "Selo," pronounced "Sea-lo"; and it is the united product of six well-known British manufacturers—Apem Ltd., Gem Dry Plate Co. Ltd., Ilford Ltd., Illingworth and Co. Ltd., Imperial Dry Plate Co. Ltd., and Wellington and Ward Ltd. The laboratories of these firms have been working together for some time with the object of producing jointly the best possible film, and it may be assumed that the "Selo" film combines the various points of excellence by which the films of the individual firms have been characterised in the past. It is claimed that "Selo" is the fastest roll film produced, and therefore it should be of value to the amateur who, in the course of our erratic summers, is often obliged to take snapshots in poor light unless he is to lose many interesting subjects. The film is also stated to be highly sensitive to colour values.

Our "Better Title" Contest

The Contest announced in the 1930 Meccano Catalogue attracted widespread interest. In it competitors were asked to suggest an alternative title for the picture on the cover, and in making choice of the best of the enormous number of entries submitted, the judges had a very arduous but pleasant task. Meccano boys in all parts of the world had scrutinised

Henry Turner, of Sheffield.

the illustration to good purpose, and it is quite clear that the majority of them also had studied very carefully the art of writing slogans, for a very large proportion of the titles were suitable for use in this manner.

After due deliberation the judges came to the conclusion that the best entry submitted was "AMATEURS TO-DAY—EXPERTS TO-MORROW." This was sent in by Master Henry Turner, Sheffield, whose portrait appears above, and to him has been forwarded a cheque for £5 together with congratulations on having thought out this neat and comprehensive title.

The judges felt that many of the efforts sent in were so good that some recognition was due to them, and accordingly a number of consolation prizes have been forwarded to their authors.

Steam Tugs

—(*Continued from page 383*)

managed to get a hawser on board, and she then drove full speed ahead, hour after hour, in order to keep the troopship's head to the wind and prevent the fire from spreading forward. The strength of the gale was such that practically no progress through the water was possible, but the tug succeeded in her desperate efforts, and stuck to the tow-rope until the gale blew itself out and the fire was got under control. Without the splendid assistance of the tug the troopship undoubtedly must have been lost, and probably with all on board, for no boats could have survived in such a sea. This episode affords a typical instance of what is perhaps the most notable characteristic of tugs and their skippers—bulldog tenacity.

One of the most extraordinary incidents in the history of tugs occurred in 1913 on the coast near Sunderland. A large German cargo steamer, the "*Orion*," had been driven hard ashore, and when the next high tides came round a determined effort was made by three powerful tugs to haul her off into deep water. After some unsuccessful attempts the tugs gathered their strength for a final desperate effort, and succeeded, not in dragging the German ship off, but in pulling her clean in two! Her hull parted amidships as cleanly as if it had been cut through.

Two large tugs of an unusual type are familiar to those crossing the Mersey by ferry or sailing from Liverpool to foreign ports. These are the tenders "*Magnetic*" of the White Star Line, and "*Skirmisher*" of the Cunard Line. These tugs are specially fitted with passenger accommodation to carry passengers to and from the liners, or to carry parties for inspection cruises; and in addition they use their power for towing the great liners of their respective companies to and from the docks and the landing stage. The "*Skirmisher*" is a particularly interesting craft. She is now quite a veteran, and must have had charge at different times of every liner in the Cunard fleet during the last 30 years. She looked tiny when towing the old "*Umbria*" or "*Lucania*"; but she seemed a midget indeed when in attendance on the "*Aquitania*" or the "*Mauretania*." Since the departure of the latter giant liners to Southampton the "*Skirmisher*" devotes her attention to the graceful new single-funnelled Cunarders that enter and leave the Mersey with the regularity of express trains.

Safety Device for Electric Railways

The "dead man's handle" has long been a familiar term to those who are interested in the London Tubes and other electric railways. This startling name is used for a safety device consisting of a special switch that the driver of an electric vehicle must press continuously in order to maintain the supply of current for the motors. If he becomes incapable or falls from his proper driving position owing to sudden illness or any other reason, the release of the switch is followed by the automatic stopping of the train.

On certain electric railways in Central Europe an ingenious invention of a more comfortable type is being substituted for the customary "dead man's handle." The new device consists of a safety belt that is buckled by the driver round his waist. A cord connects the belt to a switch fixed on a cross bar above his head, the switch being designed to slide freely along the cross bar, and not to interfere with the movements of the driver. The length of the cord is so adjusted that if the man wearing the belt falls to his knees the switch is closed. Current is thereby supplied to a small electro-magnet that cuts out the main supply and applies the emergency brake.

The device has the great advantage that it is positive in action and not wasteful of current. Only if a driver falls is current switched on, whereas in the old system the current in the control circuit flows continuously, thus adding unnecessarily to the consumption.

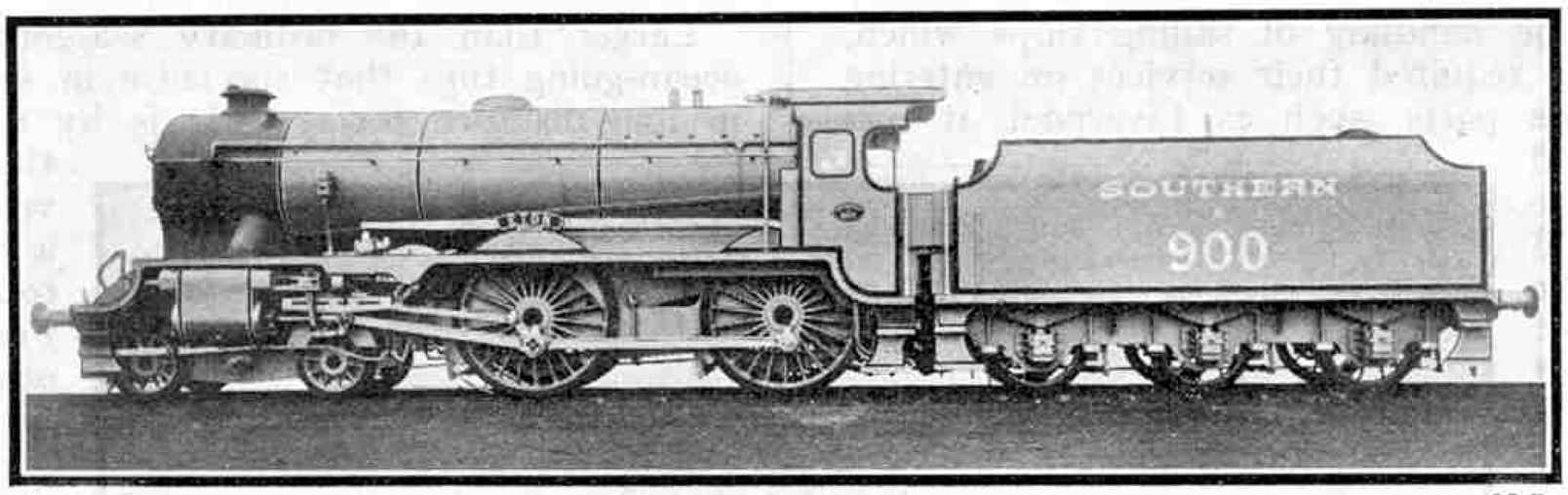
The driver of an electric train on which the safety belt is fitted may bring it to a standstill in an emergency by jumping out, for this will immediately shut off current and put on the brakes. To act in this manner is the natural impulse of a driver who sees that a collision is unavoidable and it may be done with the knowledge that this is the very best means of minimising the effect of the collision.

New S.R. "Schools" Class Locomotives

Britain's Most Powerful 4-4-0 Engines

IN the "Railway News" pages of the April "*M.M.*" the completion of the first of the 4–4–0 express locomotives of the new "Schools" class was noted. This is named "*Eton*" and is numbered E.900.

Altogether ten of the locomotives are being built. They will be numbered consecutively and will be named after famous public schools in the south of England. In addition to "*Eton*," the complete list will include "*Winchester*," "*Wellington*," "*Charterhouse*," "*Lancing*," "*Tonbridge*," "*Sherborne*," "*Dulwich*," "*Westminster*" and "*St. Paul's.*" Naturally a considerable amount of attention has been attracted to the new locomotives by the use of these names, and it is interesting to note that "*Eton*" was specially taken to the Windsor Station of the Southern Railway to enable the boys of the school—after which it was named—to inspect it.



Courtesy] [S.R.

S.R. Locomotive No. E.900, "*Eton*," the first of the new "Schools" Class. These handsome engines have a tractive effort of 25,131 lb., and are the most powerful 4-4-0 locomotives in Great Britain.

The accompanying photograph of the locomotive illustrates the handsome appearance of the engines of the new class, which have been described as pocket editions of the "Lord Nelsons." Their appearance has been eagerly awaited by railway enthusiasts, who wished to see how Mr. R. E. L. Maunsell, Chief Mechanical Engineer of the Southern Railway, would deal with the very stiff problem presented to him. The locomotives are required for hauling heavy corridor railway stock on the steep gradients and severe curves of the routes from London to Hastings and other coastal stations. Great power is necessary, but the standard loading gauge and the weight limitations necessary on these lines impose severe restrictions.

In spite of the difficulties Mr. Maunsell has produced a locomotive with a tractive effort equal to that of the "King Arthurs," and greater than that of any other engine of the 4–4–0 type yet built in this country. It is 25,131 lb., and this is actually no less than three-quarters of the tractive effort of the powerful locomotives of the "Lord Nelson" class. The new engine may be used on portions of the line where the loading gauge restrictions are very severe, for additional clearance has been given by setting the tops of the sides of the cab and the tender inward.

The locomotives of the "Schools" class are largely made up of standard parts. For instance, the cylinders, motion, bogie and other details are almost identical with those of the 4-cylinder 4–6–0 "Lord Nelson" class. The boiler is similar to that of the "King Arthurs," but has a shorter barrel and a higher working pressure. A round-topped firebox is used, the necessity for keeping down the weight of the locomotive making one of the Belpaire pattern impossible. The change allows a better outlook for the driver than probably would have been the case if a Belpaire firebox had been used in conjunction with a cab that narrows towards its roof.

Three separate sets of Walschaerts gear are provided to drive the 8 in. piston valves of the cylinders. The single-throw crank axle is of the built-up type. Under the footplate is a vacuum brake cylinder, 30 in. in diameter, and a pump driven off the inside crosshead is used to maintain the vacuum.

The cab and footplate resemble those of the "Lord Nelsons," and it is interesting to note that the lookout glasses on the driver's side are provided with window wipers. The fittings provided include an exhaust steam injector on the left hand or driver's side, and ordinary gravity sanding is employed. From our photograph it will be seen that the whistle is mounted horizontally. In this respect a practice has been followed that is becoming increasingly common as the heights of the boilers approach the limits of the loading gauge.

The tenders fitted to the locomotives of the "Schools" class are of the latest standard six-wheeled pattern and the springs on these as well as on the locomotives themselves are of the laminated type.

PRINCIPAL DIMENSIONS

Cylinders :	
Number	Three
Diameter	16½ in.
Stroke	26 in.
Wheels :	
Bogie	3 ft. 1 in. diam.
Coupled	6 ft. 7 in. diam.
Wheelbase	25 ft. 6 in.
Boiler :	
Length of barrel	11 ft. 9 in.
Length between tube plates	12 ft. 2⅛ in.
Diameter of barrel	5 ft. 5½ in.
Height of centre above rail	9 ft.
Firebox Shell :	
Width (outside at foundation ring)	4 ft. 0½ in.
Length	9 ft.
Heating Surface :	
Tubes	1,604 sq. ft.
Firebox	162 ,,
Superheater Surface ...	283 ,,
Total	2,049 ,,
Grate Area	28.3 ,,
Working Pressure	220 lb. per sq. in.
Weight in working order ...	67 tons 2 cwt.
Adhesive Weight	42 tons
Tractive effort at 85 per cent. boiler press.	25,131 lb.
Water capacity of tender ...	4,000 gallons
Coal ,, ,, ...	5 tons
Weight of tender in working order	42 tons 8 cwt.
Total wt. engine and tender in working order	109 tons 10 cwt.

Steam Tugs and Their Work

Tiny Vessels That Handle Liners

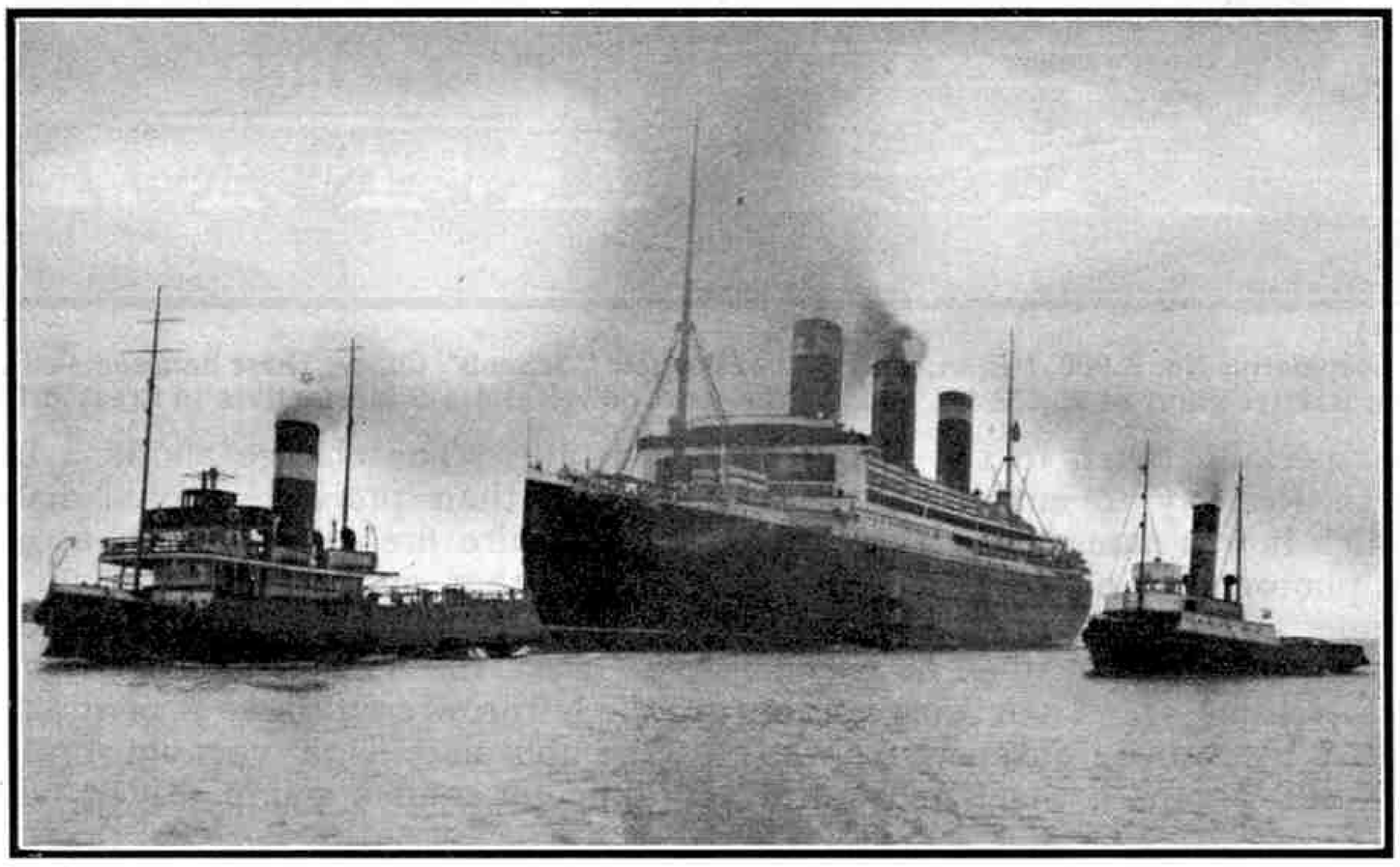
By R. S. McNaught

THE steam tug, in spite of its comparatively small size, has a history longer than that of most other types of steamships. The first definitely recorded occasion on which a steam-propelled vessel was used for towing dates back to August, 1816, when a Thames vessel named the *"Majestic"* towed a sailing ship of considerable size from Deptford to Woolwich at a speed of three miles an hour against the wind. Up to comparatively recent years tugboats were mainly concerned with the handling of sailing ships which, as a general rule, required their services on entering harbour. At some ports, such as Liverpool, it was possible, when wind and tide were favourable, for a sailing vessel to be brought into port under sail without the assistance of a tug; but many ports, such as London, could not be entered by large sailing vessels without assistance.

The sailing ship has gone, and the majority of steamships are able to enter and leave port under their own power, and in some cases to enter docks without assistance. The tug is still required, however, to assist in the task of berthing and docking liners and other steamships that are too large to be manœuvred through dock entrances under their own steam. At every busy port is stationed a small fleet of sea-going tugs, which are always in readiness to steam at high speed, in fair weather or foul, to meet an incoming liner and tow her through intricate channels into harbour, and either bring her alongside a landing stage or guide her into dock. As a rule two tugs take charge of strong manilla hawsers at the bows, while one or more act as an additional rudder by hitching on astern with engines reversed to maintain a "grip" on the tow. With the liner's engines at "stand by" or "dead slow," the small craft are in full control of her movements.

The actual docking of a large steamship is a very delicate job especially when, in the case of liners, the maximum beam may be only 10 ft. less than the width of the entrance lock. Matters are further complicated if a strong wind is blowing, for a sudden side gust pressing against her towering hull just as she is passing into the entrance may cause her to swing round dangerously. The merest grazing of the granite walls of the quayside may result in strained and buckled plates, involving a visit to the graving dock for repairs. While engaged in this work the tugs have to be as responsive to the demands of the moment as a bicycle ridden through a crowded London street. Their movements are directed by an officer on the liner's lofty bridge in co-operation with the harbour-master's staff on the quayside, the manœuvring being controlled by means of a simple code of whistle signals.

Larger than the ordinary sea-going tugs are the ocean-going tugs that specialise in salvage work and in long-distance towage. It is by no means a rare thing for these vessels to undertake a voyage half-way round the world. For some reason or other the Dutch have specialised in ocean towing, and they have evolved some remarkably efficient vessels specially designed for such work. Among their many notable achievements is that of towing a floating dock, 400 ft. in length and 95 ft. in breadth, from the builders' yard on the Tyne to a port on the coast of Peru, a distance of over 10,000 miles. During this voyage the dangerous and intricate Straits of Magellan were safely negotiated. Such a tow cannot proceed at a speed of more than six or seven knots in calm weather, and therefore the tugs had to carry huge supplies of coal and provisions, in addition to large quantities stowed on the floating dock.



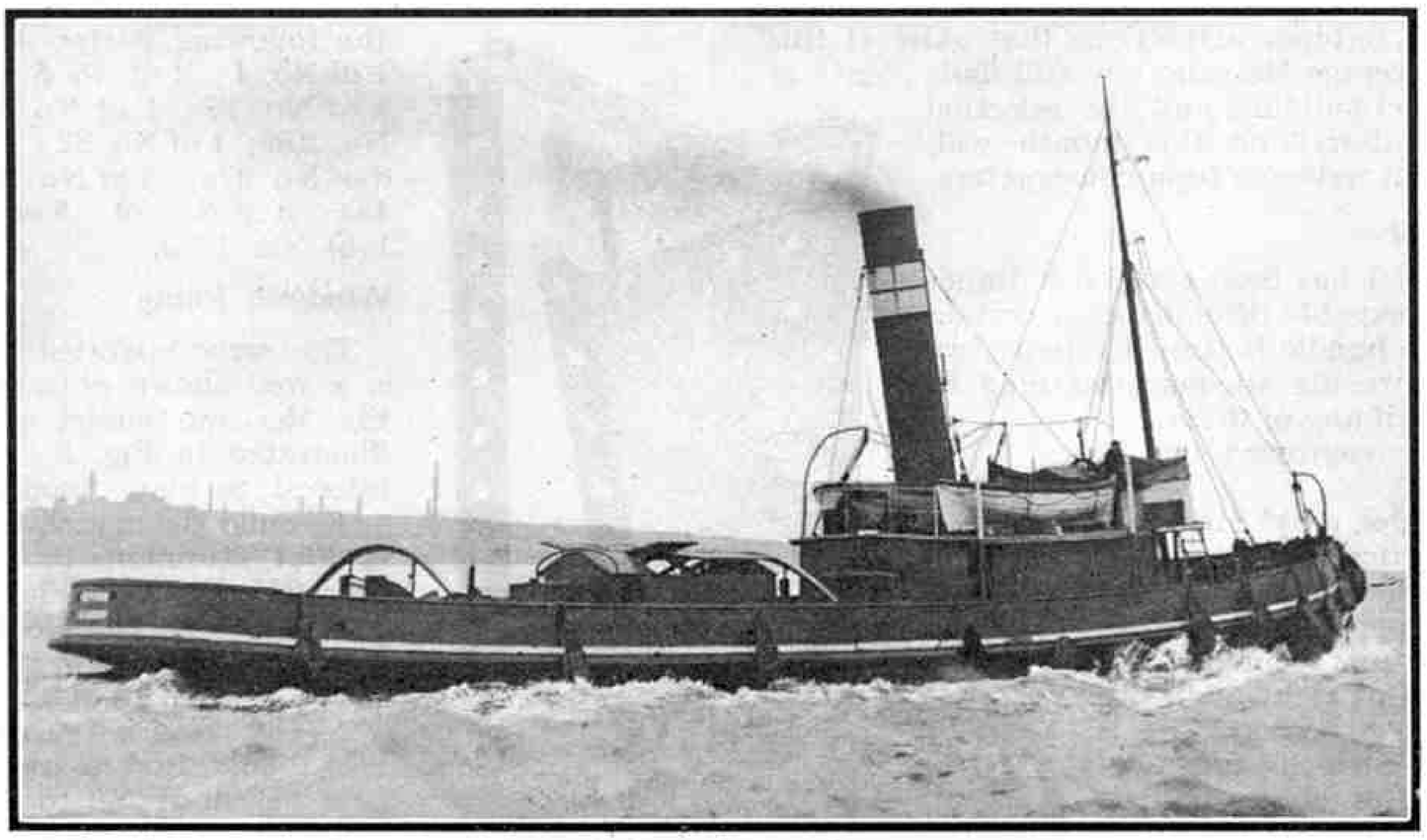
Tugs towing the giant American liner "*Leviathan*" to her berth at Southampton.

Most of the Dutch ocean-going tugs may be recognised by their two tall funnels and two masts. The British ocean-going tugs are smaller than the Dutch vessels, but are in no way inferior. In proof of this may be mentioned the famous Liverpool "Cock" fleet, so called because they are named *"Storm Cock," "Black Cock,"* and so on. They are always ready to undertake difficult tasks in any part of the world, and they have many notable exploits to their credit.

There are other classes of steam tugs which, while designed primarily for towage work, undertake additional duties for which they are provided with special equipment. Some are used for salvage work and have tremendously powerful pumps for assisting a stranded or sinking vessel. Others again are fire-fighters, ready at a moment's notice to pump enormous quantities

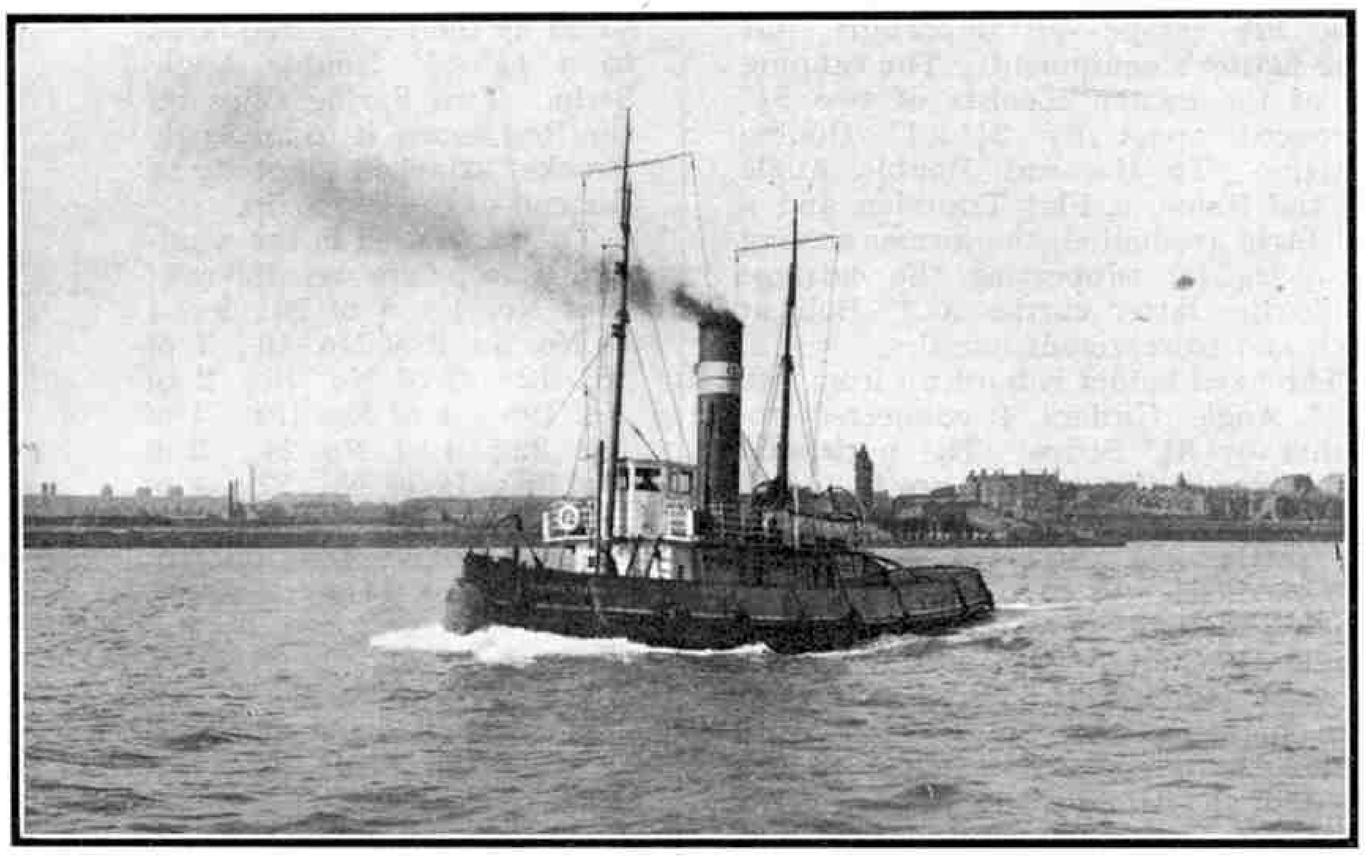
of water on to blazing ships, or on to burning warehouses along the waterside.

All steam tugs are very stoutly built as they have to withstand a tremendous amount of buffeting from stormy seas and also in the rough-and-tumble of their everyday work. They are exceptionally broad of beam and are designed so as to have a low centre of gravity to enable them to heel over to an acute angle with safety, as they often do when straining at a taut hawser. Their freeboard is low, and in bad weather few dry corners are to be found on board; while their trawler-shaped hull and shallow draught makes these little steamers as lively as corks when the sea is rough. Of necessity they are powerfully engined. A tug of, say, 500 tons gross may have engines of from 1,000 h.p. to as much as 1,300 h.p. The speed at which quite small tugs can move when running free is surprising, and it gives a good indication of their engine power. As a rule the propelling machinery consists of reciprocating engines driving twin screws, but recently a considerable number of tugs have been fitted with internal combustion engines.



A typical sea-going tug, showing the wooden arch over which the tow-rope is passed.

The actual towing gear consists of a heavy steel hook built into a specially reinforced bulkhead abaft the funnel, and placed as low down as possible. Occasionally a second towing hook is fixed astern or in rear of the engine-room casing, but this is suitable for light work only. In the United States the tugs make use of a special windlass for towing purposes instead of a hook. As a matter of fact these American tugs usually handle a liner, not by towing, but by placing their noses against her plates and pushing.



An ocean-going tug fitted with wireless.

When fastened to the usual type of towing hook the towing wire lies a little higher than the axis of a pivoting bolt round which the hook can turn. There is a slipping device on the hook controlled by a wire from the bridge, and between the hook and the stern is a strong wooden arch over which the tow-rope passes. This arch is one of the most noticeable features of a tug.

For open sea work a particularly long and heavy hawser is employed, designed to withstand the sudden jerks that are inevitable in rough weather. Many ocean-going tugs are fitted with an automatic towing device that counteracts the effects of these sudden strains by paying out or taking in the hawser according to the demands of the moment. A long tow-line, owing to its own weight, is submerged for part of its length, and a floating buoy is attached midway to indicate the presence and position of the line. After dusk an extra white light is carried at the masthead of a tug to denote that she has a vessel in tow. On such a river as the Mersey, where a tug often may have to tow a string of five or six barges from dock to dock, a corresponding number of lights must be displayed.

The living accommodation provided on steam tugs is similar to that on a steam trawler or drifter, which means that it is both limited and rough and ready. Ocean-going tugs usually have a forecastle, but this is not the case with the tugs that rarely lose sight of their own estuary or bay. A normal crew for a sea-going tug consists of skipper, mate, engineer, three or four deck hands and greasers, and a lad who looks after the cooking and cleaning. At low tide, or when for other reasons work is slack, much time is spent in painting and polishing the tug which, in rough weather, comes back from every job salt-encrusted and dingy. However small and weather-beaten a tug may be, her crew, from the skipper downward, are proud of her, and one never meets a tugman whose boat is even second best on her particular stretch of coast!

Much might be written of the adventures that tugs encounter in their intricate and often dangerous work. Risks of all kinds have to be faced, and the tug skipper takes them as they come without the slightest hesitation or fuss. On one occasion a tug went out to sea in the teeth of a howling gale to aid a large troopship that was on fire astern. The forward holds contained explosives, and the troops on board were crowded forward. Approaching as closely as was possible in the raging seas, the tug

(Continued on page 380

New Meccano Models

Mechanical Gong—Fire Escape—Windmill Pump—Excavator

IN spite of the numerous outdoor attractions that exist at this time of the year, the average Meccano boy still finds plenty of opportunities for model-building, and the selection of models which we are describing this month will, we feel sure, receive a warm welcome from constructors.

A Mechanical Dinner Gong

The model shown in Fig. 1 has been called a " dinner gong," but although it is capable of emitting a certain amount of sound when the handle is turned rapidly, we doubt whether it would provide adequate warning to intending diners, especially if any of these were Meccano boys deeply engrossed in building a new model!

In order to build the model, a 5½" Strip should be bolted in a vertical position to a 5½" × 2½" Flanged Plate forming the base. This Strip carries at its upper end an Angle Bracket to which a 3½" Strip is secured, a 2½" Strip in turn, being bolted at right angles to the end of the 3½" Strip. A Sector Plate is suspended from the latter Strip by means of two short pieces of string or elastic, and is attached to the base by similar means. The operating handle is journalled in two 2½" Strips held by means of Flat Trunnions to the 5½" × 2½" Flanged Plate, and carries a Bush Wheel, to which four Flat Brackets are bolted. As the handle is turned, the Flat Brackets strike the Sector Plate, thus causing a ringing sound.

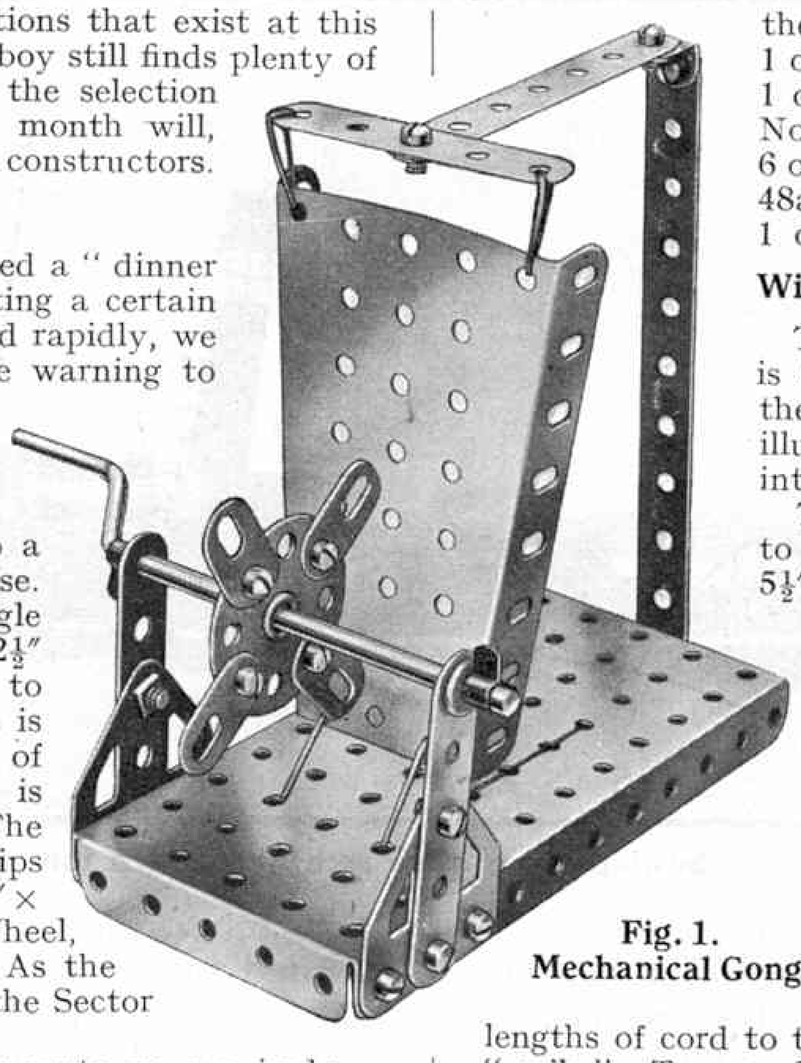


Fig. 1. Mechanical Gong.

In order to build the Gong the following parts are required :— 1 of No. 2 ; 1 of No. 3 ; 3 of No. 5 ; 4 of No. 10 ; 1 of No. 12 ; 1 of No. 19 ; 1 of No. 24 ; 2 of No. 35 ; 16 of No. 37 ; 2 of No. 38 ; 1 of No. 52 ; 1 of No. 54 ; 2 of No. 126a.

Extending Fire Escape

Fig. 2 shows an interesting model of an extensible fire escape—an important unit in the fire fighter's equipment. The running carriage of the escape consists of two 5½" Strips spaced apart by 2½" × ½" Double Angle Strips. To the end Double Angle Strip of the frame, a Flat Trunnion and a 3½" Strip are bolted, the former serving as a leg for supporting the carriage while the latter carries a ⅜" Bolt at each end to represent handles.

The fixed ladder is built up from two 12½" Angle Girders 4 connected together by 3½" Strips. The horizontal 5½" Strips of the carriage are bolted to the Girders and the whole is held rigid by further 5½" Strips 7 secured to the carriage, and to the Girders 4 by Angle Brackets. Two ½" × ½" Reversed Angle Brackets 5 form guides for the movable ladder, which may be extended by operating the Crank Handle 2. A length of cord is attached to the shaft of the Handle and passes over a ½" Pulley 1 mounted on a ⅜" Bolt that is fixed by means of two nuts to an Angle Bracket on the ladder ; the cord is tied finally to the 2½" Strip that forms the base of the operating ladder. A 1" Pulley 3 mounted on the Crank Handle serves as a brake drum, around which a length of cord is passed and tied to a 3" Strip carrying the ¾" Flanged Wheel 6, which acts as a weight. The 3" Strip is pivoted on a ⅜" Bolt attached to one of the Strips 7.

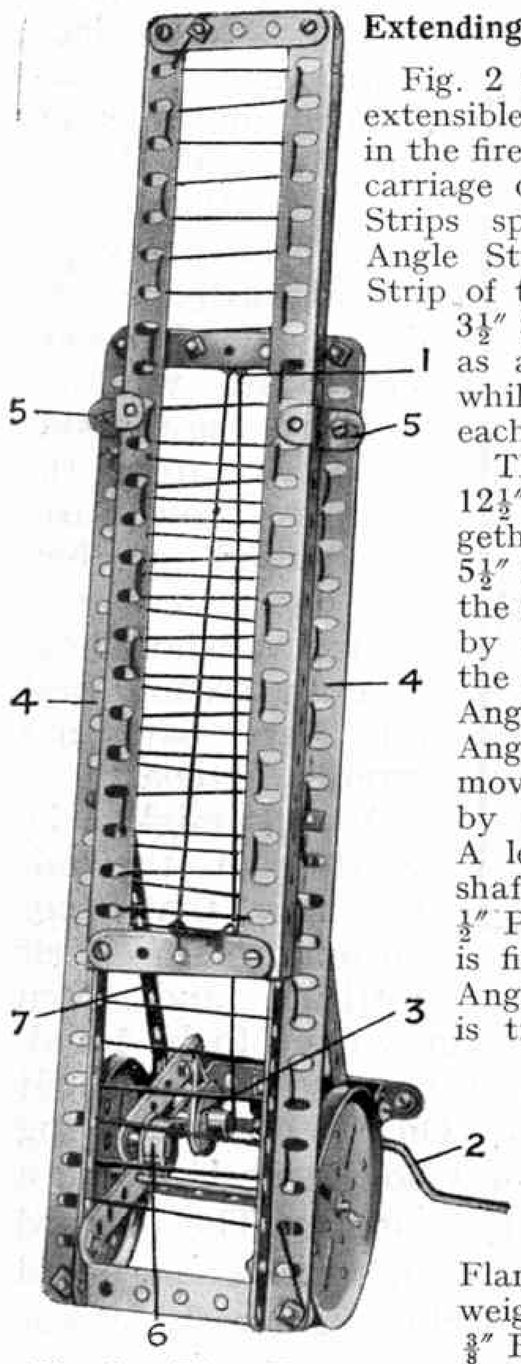


Fig. 2. Fire Escape.

The model Fire Escape contains the following parts : 4 of No. 2 ; 3 of No. 3 ; 1 of No. 4 ; 2 of No. 5 ; 4 of No. 8 ; 3 of No. 12 ; 1 of No. 16 ; 1 of No. 19s ; 2 of No. 19b ; 1 of No. 20b ; 1 of No. 22 ; 1 of No. 23 ; 26 of No. 37 ; 6 of No. 37a ; 5 of No. 38 ; 2 of No. 40 ; 2 of No. 48a ; 3 of No. 59 ; 5 of No. 111c ; 2 of No. 125 ; 1 of No. 126a.

Windmill Pump

The wind-operated mechanical water pump is a well-known object on many hill-sides, and the Meccano model of one of these machines illustrated in Fig. 3 should consequently be of interest to many model-builders.

To build the model, two 12½" Strips are secured to Flat Trunnions that in turn, are bolted to a 5½" × 2½" Flanged Plate forming the base. A 2½" × ½" Double Angle Strip is bolted in position between the two vertical Strips, to add strength to the structure, and a 3½" Rod is journalled in their upper ends. This Rod carries four 1" Pulleys and a Bush Wheel to which eight 5½" Strips are bolted to form vanes ; the ends of these Strips may be twisted slightly to obtain greater realism.

A Crank Handle is journalled in the vertical members, and carries two 3" Pulleys that are connected by endless lengths of cord to two of the 1" Pulleys on the Rod carrying the " sails." To one of the 3" Pulleys a 2½" Strip is attached pivotally by a ⅜" Bolt passed through its centre hole and secured rigidly by two nuts. The Strip is spaced from the Pulley by Washers.

The pump consists of a 3½" Axle Rod passed through two Flat Brackets that are secured by their elongated holes to a 1½" × ½" Double Angle Strip. Two Spring Clips on the Rod secure it to an Angle Bracket attached pivotally to the end of the 2½" Strip.

The parts used in the windmill pump are as follows : 2 of No. 1 ; 8 of No. 2 ; 1 of No. 5 ; 2 of No. 10 ; 1 of No. 12 ; 2 of No. 16 ; 2 of No. 19b ; 1 of No. 19s ; 4 of No. 22 ; 1 of No. 24 ; 2 of No. 35 ; 19 of No. 37 ; 4 of No. 37a ; 8 of No. 38 ; 1 of No. 48 ; 1 of No. 48a ; 1 of No. 52 ; 3 of No. 111c ; 2 of No. 126a.

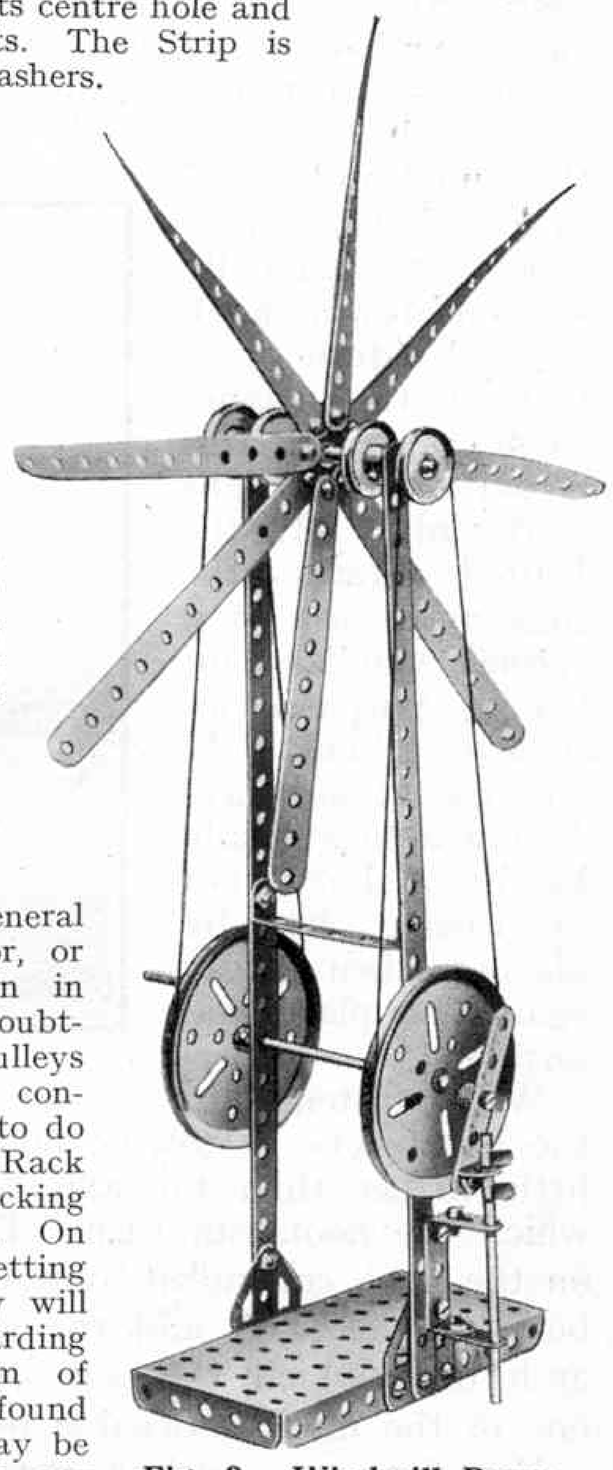


Fig. 3. Windmill Pump.

Mechanical Excavator

On first glancing at the general view of the model excavator, or " mechanical navvy," shown in Fig. 5, model-builders will doubtless be surprised to see 2" Pulleys and Dunlop Tyres used in conjunction with Angle Girders to do service for Pinions and Rack Strips respectively in the racking motion of the digger arm. On building the model and setting it in motion, however, they will have no further doubts regarding the efficiency of this form of construction, for it will be found to work perfectly, and it may be fully recommended for use in any

other model when the more orthodox pinions and racks are not available.

The base of this model consists essentially of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates connected together by $12\frac{1}{2}''$ Angle Girders, and the vertical member 1 is secured firmly to a 2″ Sprocket Wheel 2 that is free to turn about a Pivot Bolt attached to one of the base plates. It should be noted that the $2\frac{1}{2}'' \times 1''$ Double Angle Strip 3 is spaced from the Sprocket 2 by two Washers.

The gear box provides four movements—hoisting, lowering, racking, slewing, and travelling, all of which are driven by the Electric Motor. On the armature spindle of the Motor is a Worm meshing with a $\frac{1}{2}''$ Pinion on a horizontal Rod on which is secured also a $\frac{3}{4}''$ Contrate. The latter is in constant mesh with a $\frac{1}{2}''$ Pinion 4 on a short Rod that is journalled in the Motor side plates and carries a Worm 5.

The slewing and travelling motions are actuated through a novel form of clutch. A 57-teeth Gear 6 meshes with the Worm 5. It is loose on its Rod 10 and may be raised or lowered by means of two Cranks 9, which are secured to a Rod and have in their end holes bolts, the shanks of which engage with the underside of the Gear. When the Gear is moved downwards, one of two $\frac{3}{4}''$ Bolts 6a secured to it, engages with one of the holes in a 2″ Sprocket 7 which is loose on the Rod 10 and is connected to the Sprocket 2 by a length of Sprocket Chain. By this means the model is slewed. By raising the Gear 6 the second $\frac{3}{4}''$ Bolt engages with a Bush Wheel 8, which is fastened to the Rod 10. A 1″ fast Pulley 11 on the lower end of this shaft is connected by a short belt of cord to a similar Pulley on the front driving axle of the model.

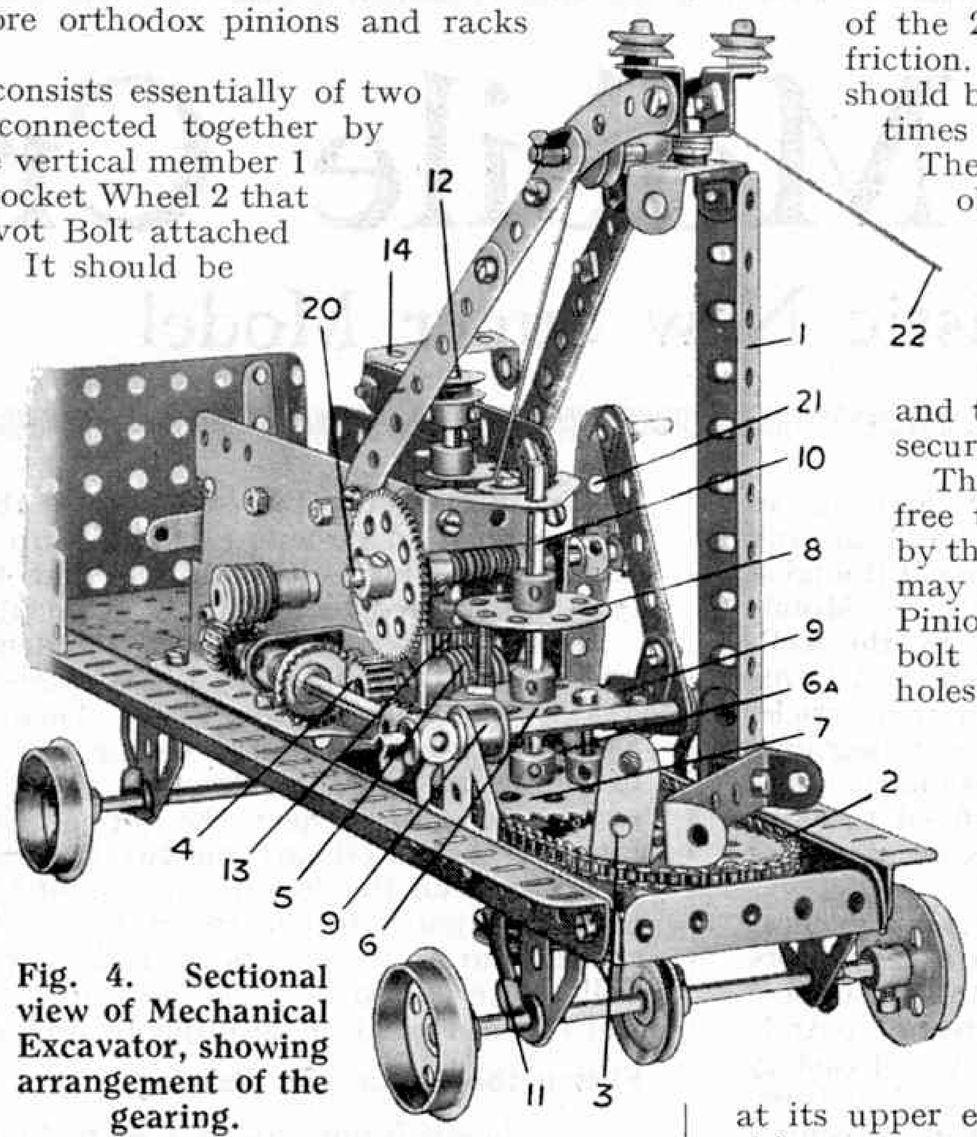


Fig. 4. Sectional view of Mechanical Excavator, showing arrangement of the gearing.

It should be borne in mind that the Gear 6 must be always in mesh with the Worm 5, unless it is required to throw it out of gear entirely, when it is only necessary to slide it up the Rod to its fullest extent. To prevent the Gear coming out of mesh with the Worm when in the slewing position, a Collar is fixed on the lower $\frac{3}{4}''$ Bolt, and in order to maintain the operating lever in position after movement, a Spring Clip 9a is mounted on the end of the Rod carrying the Cranks 9, and prevented from rotation by its ends engaging with a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket bolted to the Flat Trunnion. Hence the required stiffness in the movement of the lever is obtained.

The drive for the racking movement is taken off a $\frac{1}{2}''$ fast Pulley 12 secured to the top end of a Rod that carries a $\frac{1}{2}''$ Pinion 13, which may be brought into mesh with the Worm 5 by sliding the Rod downward with the aid of the lever 14. An endless length of cord connects the Pulley 12 with a 2″ Pulley 15 secured on a Rod that is journalled in the sides of the jib, and which carries 2″ Pulleys, shod with Dunlop Tyres. The Rod also carries a "yoke" formed from two pairs of $2\frac{1}{2}''$ Strips, one pair being slipped on each end of the Rod, and the upper ends of the Strips are bolted to two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips that are held apart by two $2\frac{1}{2}''$ Strips. Four Angle Brackets are secured to the $3\frac{1}{2}''$ Angle Strips, as can be seen in Fig. 5, and the Angle Girders forming the bucket arm are pushed in between the Angle Brackets and the outer surfaces of the 2″ Dunlop tyres and are held firmly in place by friction. The endless cord connecting Pulleys 15 and 12 should be passed round the grooves of these Pulleys several times in order to preclude any possibility of slipping.

The construction of the bucket itself should be fairly obvious from Fig. 5, with the exception of the catch for releasing the hinged bottom. The catch consists of a $1\frac{1}{2}''$ Rod free to slide in a Double Bracket that is bolted rigidly to the underside of the bucket. One end of the Rod is fitted with a Coupling, to which the release cord is attached, and the other end fits into the lower hole of a 3″ Strip secured to the front of the bucket.

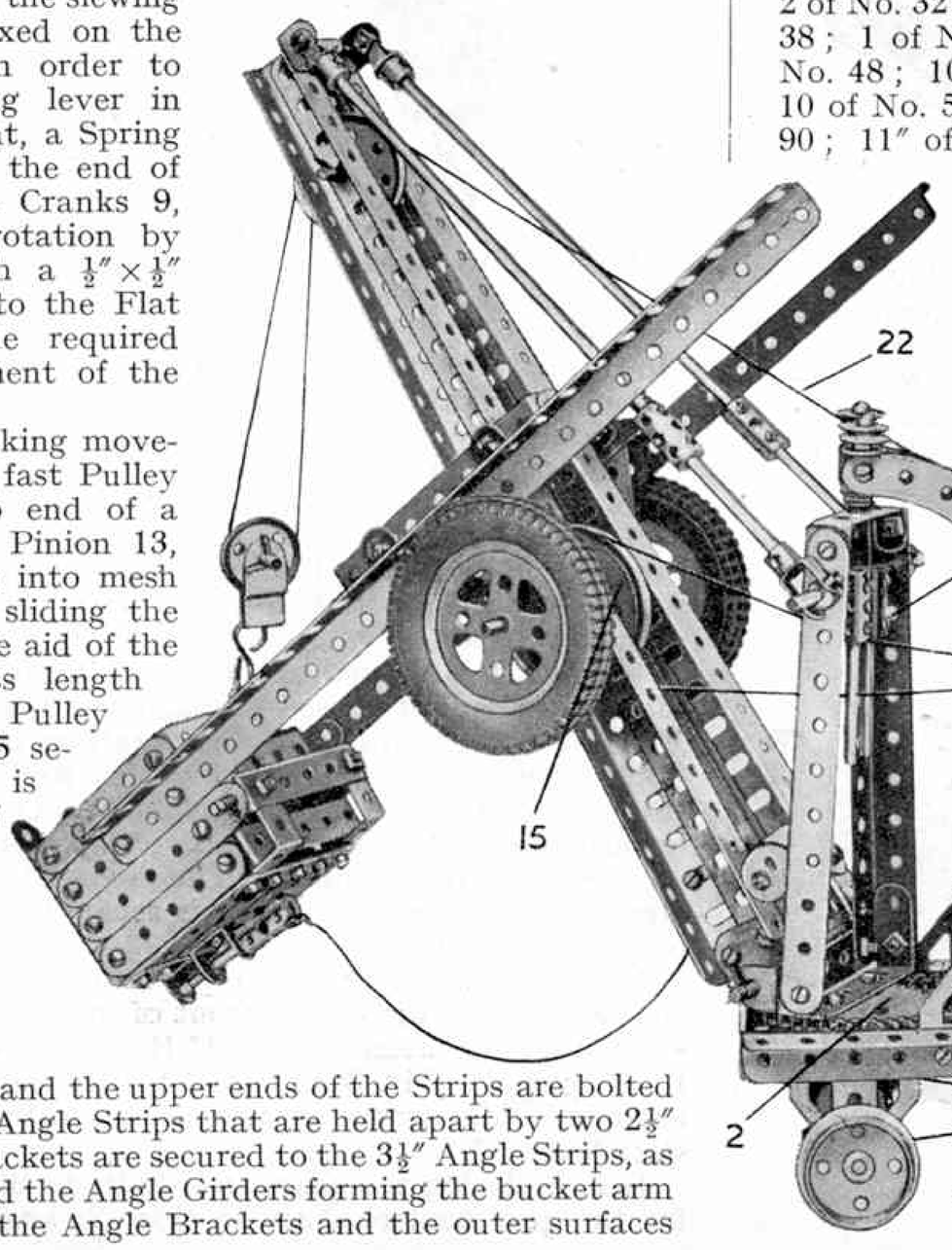
The hoisting winch consists of a $3\frac{1}{2}''$ Rod 20 that is free to slide in the Motor side plates and is controlled by the lever 21, so that the 57-teeth Gear on its extremity may be thrown into or out of engagement with the $\frac{1}{2}''$ Pinion 4. When out of gear the projecting shank of a bolt on the Motor side plate engages with one of the holes of the 57-teeth Gear and thus prevents the unwinding of the winch. The grub-screw in the boss of the Pinion 4 should be filed, if necessary, so that it does not foul the teeth of the 57-teeth Gear when the latter is disengaged.

The pair of $\frac{1}{2}''$ loose Pulleys mounted at the top of the vertical member form guides round which the hoisting cord 22 passes when the jib is slewed round. The Boiler is retained in position by a $6\frac{1}{2}''$ Rod, which passes completely through it, and through the base plate, and is secured by a Bush Wheel on its lower end, and at its upper extremity by a $\frac{3}{4}''$ Flanged Wheel that forms the chimney cap.

Although the model is shown fitted with a built-up bucket composed of Strips and other parts it would be a better plan to use the Digger Bucket, Part No. 169, if this is available. When using the special unit, a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip should be bolted to the back of the Bucket and to the extremities of the Angle Girders forming the bucket arm. The release cord should be attached to the special release bar on the hinged bottom instead of to the Coupling as in Fig. 5.

The following is a complete list of the parts included in the model excavator :—

6 of No. 2 ; 2 of No. 2a ; 6 of No. 3 ; 4 of No. 4 ; 18 of No. 5 ; 2 of No. 6a ; 8 of No. 8 ; 2 of No. 9 ; 3 of No. 10 ; 1 of No. 11 ; 12 of No. 12 ; 4 of No. 12a ; 3 of No. 14 ; 1 of No. 15 ; 5 of No. 15a ; 5 of No. 16 ; 5 of No. 17 ; 4 of No. 18a ; 4 of No. 20 ; 3 of No. 20a ; 1 of No. 20b ; 1 of No. 21 ; 2 of No. 22 ; 1 of No. 22a ; 3 of No. 23 ; 1 of No. 23a ; 2 of No. 24 ; 2 of No. 26 ; 2 of No. 27a ; 1 of No. 29 ; 2 of No. 32 ; 10 of No. 35 ; 125 of No. 37 ; 7 of No. 37a ; 21 of No. 38 ; 1 of No. 40 ; 1 of No. 44 ; 1 of No. 45 ; 1 of No. 46 ; 2 of No. 48 ; 10 of No. 48a ; 2 of No. 52 ; 4 of No. 53 ; 1 of No. 57 ; 10 of No. 59 ; 2 of No. 62 ; 6 of No. 63 ; 2 of No. 77 ; 3 of No. 90 ; 11″ of No. 94 ; 2 of No. 95 ; 2 of No. 103f ; 2 of No. 111 ; 3 of No. 111c ; 2 of No. 115 ; 1 of No. 116a ; 3 of No. 126 ; 4 of No. 126a ; 2 of No. 142a ; 1 of No. 147b ; 1 of No. 162 ; 1 of No. 163 ; 1 of No. 164 ; 2 of No. 165 ; 1 of No. 166 ; 1 Electric Motor.



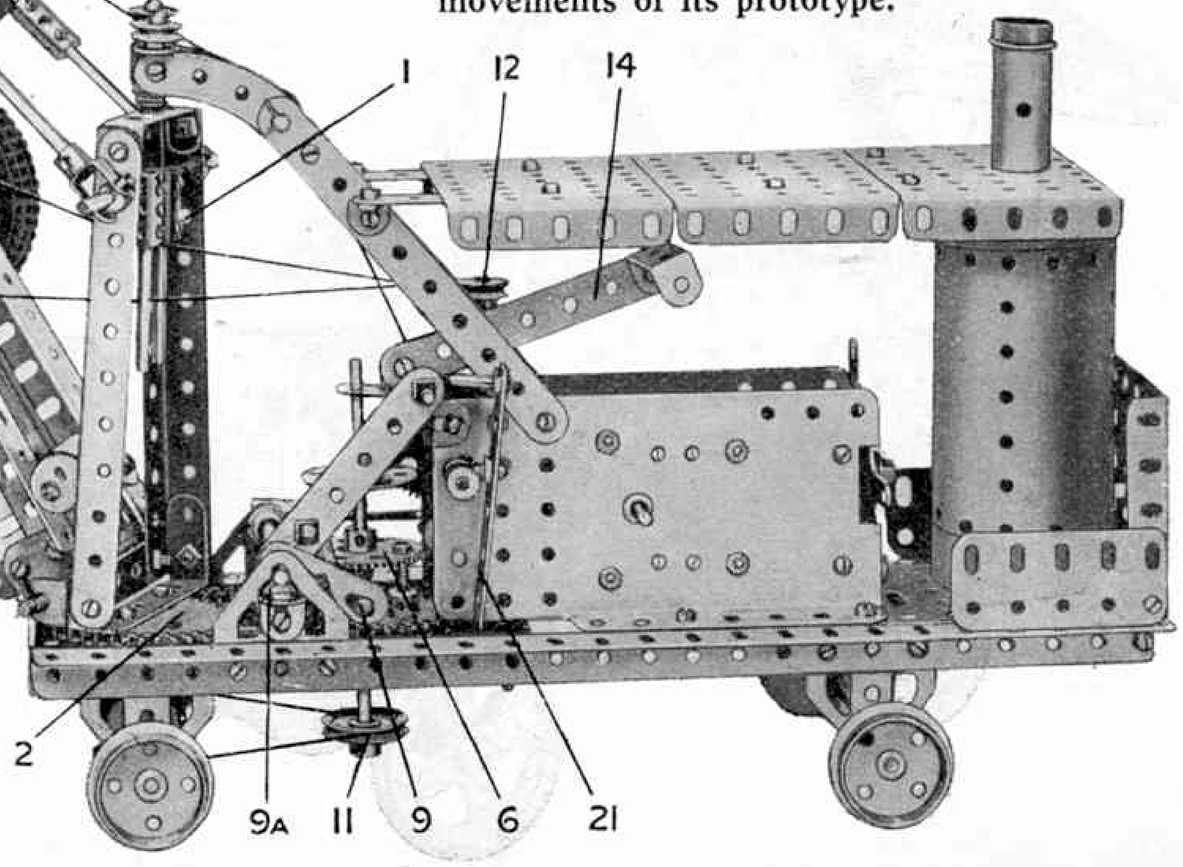


Fig. 5. Mechanical Excavator ; a realistic model embodying all the movements of its prototype.

Electric Mobile Crane

A Realistic New Super Model

IN recent years numerous devices have been invented in an endeavour to solve the problem of high-speed handling and transportation of materials and merchandise. One of the most interesting of these is undoubtedly the Petrol-electric Mobile Crane, which is manufactured to patented designs by the well-known firm of Ransomes and Rapier Ltd., of Ipswich, and forms the subject of the new Meccano model described in this article.

The actual crane comprises an entirely self-contained power unit and combines the stability and efficiency of a stationary crane with extreme mobility, and as its travel is not confined to a set of rails, or hindered by trailing cables from an external power supply, its range of utility is well nigh unbounded.

The power unit consists of a petrol engine which drives a generator that, in turn, supplies current to the luffing and hoist motors and to the two traction motors incorporated in the "castor" that is pivoted at the rear of the chassis—hence the term "petrol-electric." The crane is slewed by rotation of the pivoted castor, which is connected to an orthodox steering wheel placed in front of the operator's seat, while the luffing, hoisting, and travelling operations can each be brought into play by the movement of levers within easy reach of the operator. The task of controlling one of these cranes is consequently very similar to driving a motor car!

The Meccano model reproduces all the functions of the actual crane, with the aid of a single Meccano 6-volt Motor and an ingenious gear box. The model also includes a limit switch to prevent overwinding of the jib, an automatic brake on the hoist shaft, and foot brakes on the luffing shaft and front road axle.

Construction of the Model: The Jib

The main frame of the jib consists of two 18½" Angle Girders held apart at the rear end by a 4½" Girder and at the front by a 2½" Angle Girder; a 3½" Strip is also bolted between the 18½" Girders as shown in Fig. 1. The jib is braced by a framework secured to its under surface.

A 2½" Flat Girder is secured to each of the 18½" members and a pair of 5½" Girders are attached to the Flat Girders and also to the end holes of the 18½" Girders. A pair of 13½" compound girders, each built up from one 5½" and one 9½" Girder, are also bolted to the Flat Girders, while their upper ends are secured to the front of the jib-frame.

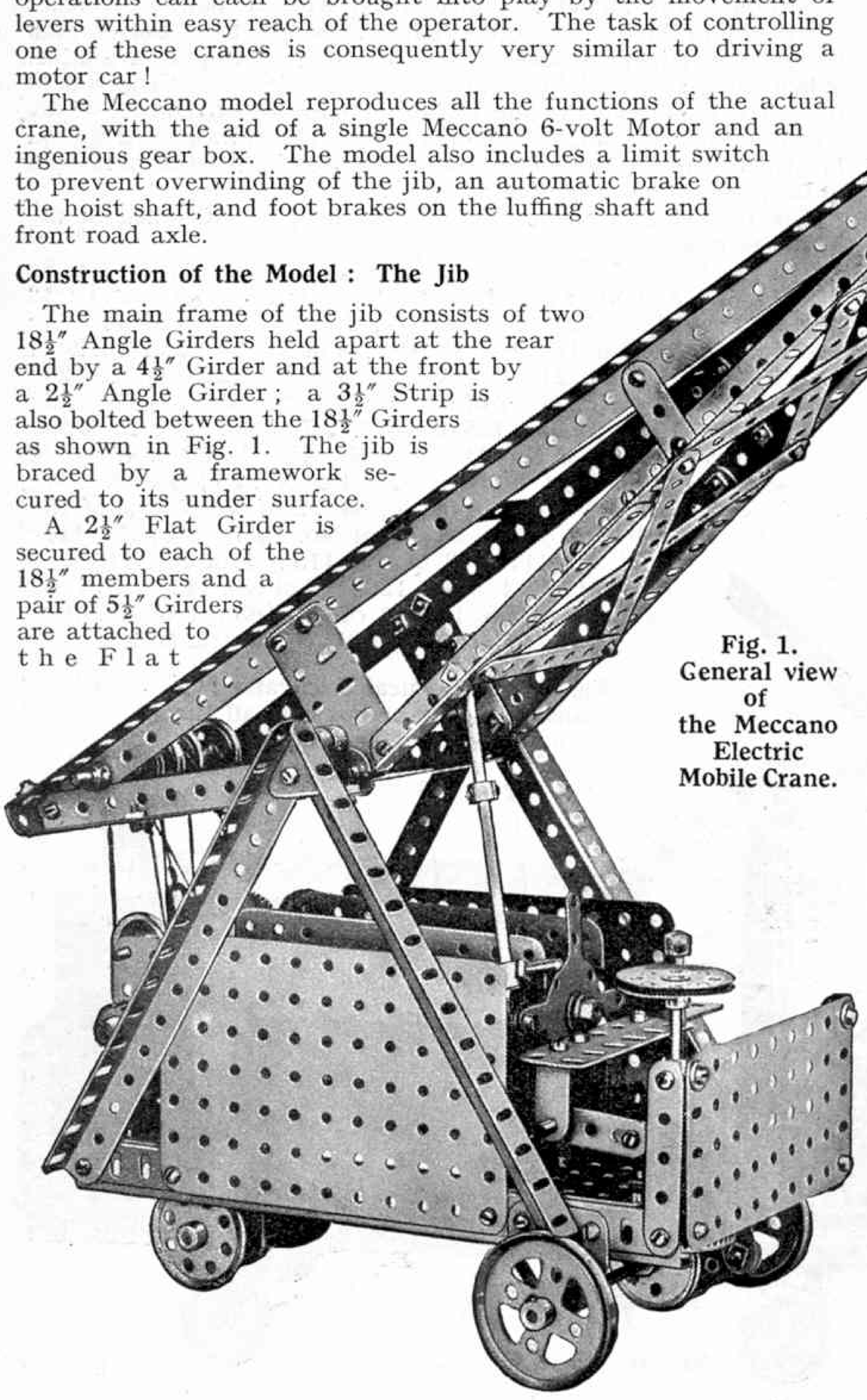


Fig. 1. General view of the Meccano Electric Mobile Crane.

In order to counteract any tendency to bend or "buckle" under load, the compound 13½" Girders are braced by 2½", 3½" and 5½" Strips secured diagonally between them. Two diagonal 5½" Strips are also bolted to the pair of 5½" Girders at the rear of the frame. Angle Brackets are bolted to each of the 13½" compound girders near the top of the jib to provide journals for a 2½" Axle Rod carrying two 1" loose Pulleys, these being kept in position on the Rod by means of Collars. A 5" Axle Rod 61 (Fig. 4) is journalled in the frame of the jib at the rear end, and carries four 1" loose Pulleys, 1, 2, 3, 4, and two Flat Brackets 5. Collars are placed between each of the Pulleys and also on either end of the Rod itself in order to prevent lateral movement.

Fitting the Motor and Gearing

The chassis frame can be seen in Figs. 2 and 3. Its sides comprise U-section girders, each built up from two 9½" Girders, and a 4½" Angle Girder is bolted to these at the front and rear. A further 4½" Girder is bolted between the two side members, six holes from the front end of the chassis, and a 3" Girder is secured to the centre of this and also to the 4½" Girder forming the front end of the frame. The rear of the frame is covered by a footplate consisting of a 4½" × 2½" Flat Plate while a 2½" × 2½" Plate is attached to the front right-hand side of the frame. Flat Plates are also attached in an upright position to the front and side girders, but these should not be bolted in place until a later step in the construction of the model.

Two 2½" Angle Girders are secured to the 2½" × 4½" Flat Plate and to the rear 4½" Flat Girder, and 2½" × 2½" Flat Plates are bolted to them. These Plates form journals for the shafts of the gear box and also provide support for one end of the Electric Motor. The Motor gearing should now be built up, and the Motor itself may afterwards be secured in position on the chassis, and the gear box and other fittings added.

A Worm 26 (Fig. 3) mounted on the armature shaft of the Motor meshes with a ½" Pinion 25 (Fig. 4) which is secured to one end of a 2" Axle Rod journalled in a Channel Bearing bolted to the Motor side plate. In fixing the Bearing to the side plate of the Motor, a Washer should be placed on each of the securing bolts to space the Bearing the correct distance from the Motor.

A Bevel 24 is secured to the other end of the 2" Axle Rod and meshes with a further Bevel that is mounted on a shaft journalled in the Motor side plates. This latter shaft also carries the ½" diameter ½" wide Pinion 51 (see Fig. 3).

The Motor is secured to the side plates of the gear box by means of a 3" Axle Rod passed through the top holes of the 2½" × 2½" Flat Plates and through the perforations in the Motor side plates, Collars being employed to keep this Rod in place. Packing, in the form of three Washers, should also be slipped on to the Rod against the right-hand side plate of the Motor in order that perfect rigidity may be obtained. The front of the Motor rests on the lateral 4½" Angle Girder, and is secured rigidly to this by means of ½" × ½" Angle Brackets.

The operator's seat (see Figs. 1 and 3) consists of a 3" Flat Girder attached directly in front of the Motor switch to the lateral 4½" Girder by means of 1" × ½" Reversed Angle Brackets. A 3½" Rack Strip 46 (Fig. 3) is bolted to the seat and projects from the left-hand side, where it acts as a "catch plate" for the gear shift lever 57.

Before placing the gears and shafts in the gear box the support for the gear control shaft 45 (Fig. 2) and selector arm must be

fitted. This consists of an Angle Bracket that is secured to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted between the side plates of the gear box in the position shown in Fig. 4, the round hole of the Angle Bracket providing one journal for the Rod 45. The latter is supported at the front end of the model in the lateral $4\frac{1}{2}''$ Girder.

The Rod 45 carries a Crank, which forms the "selector arm" and is fitted with a bolt secured in its slotted hole, the web of the Crank being butted against the face of the Angle Bracket in which the Rod 45 is journalled. A Coupling 44 (Fig. 2) is secured to the front end of the Rod and carries a 2" Axle Rod 57 fitted with a Collar forming the gear control lever, the Rod 57 being pressed tightly against the teeth of the Rack 46, thus preventing unwanted movement of the gears in the gear box.

The sliding primary shaft of the gear box consists of a $3\frac{1}{2}''$ Axle Rod carrying a 57-teeth Gear Wheel which takes the drive from the Pinion 51 (Fig. 3) a $\frac{3}{4}''$ Pinion 49, and two Collars placed one on either side of the bolt secured in the Crank forming the selector arm. A Collar 20 (see Fig. 4) is also secured to the extreme end of this shaft.

A secondary shaft, which does duty as the hoist drum, is journalled in the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates two holes directly above the sliding primary shaft, and carries the 50-teeth Gear 7, a 1" fast Pulley 27 and two Collars, one of which is fitted with a standard bolt in place of its set-screw to provide an "anchorage" to which one end of the hoist cord may be tied.

The luffing shaft 15 carries a 50-teeth Gear 14 (Figs. 3 and 4) and a 1" fast Pulley 9, the two Collars securing this Rod in place each being equipped with a standard bolt to which the ends of the luffing cord are secured. A further $3\frac{1}{2}''$ Rod, mounted two holes above the shaft 15, carries two 1" fast Pulleys 8 and 28 and a Flat Bracket 6 mounted between two Collars in a central position on the Rod.

The operation of the gears in the gear box is as follows. The Gear 10 remains constantly in mesh with the Pinion 51. For travelling, the gear lever 57 is pulled hard over to the right against the end of the operator's seat. This causes the $\frac{3}{4}''$ Pinion 49 to engage with the $\frac{3}{4}''$ Contrate 29, and the drive from the Motor is then transmitted to one of the road wheels of the castor, in the manner to be described later.

To operate the jib, the lever 57 is pushed slightly to the left, thus disengaging the $\frac{3}{4}''$ Pinion 49 from the $\frac{3}{4}''$ Contrate 29, and bringing it into mesh with the 50-teeth Gear 14 on the shaft on which the luffing cords are wound.

The last of the three movements—that of hoisting the load—is brought into action by moving the lever 57 still further to the left. Pinion 49 is then disengaged from the Gear Wheel 14 and engaged with the 50-teeth Gear 7 mounted on the hoisting shaft.

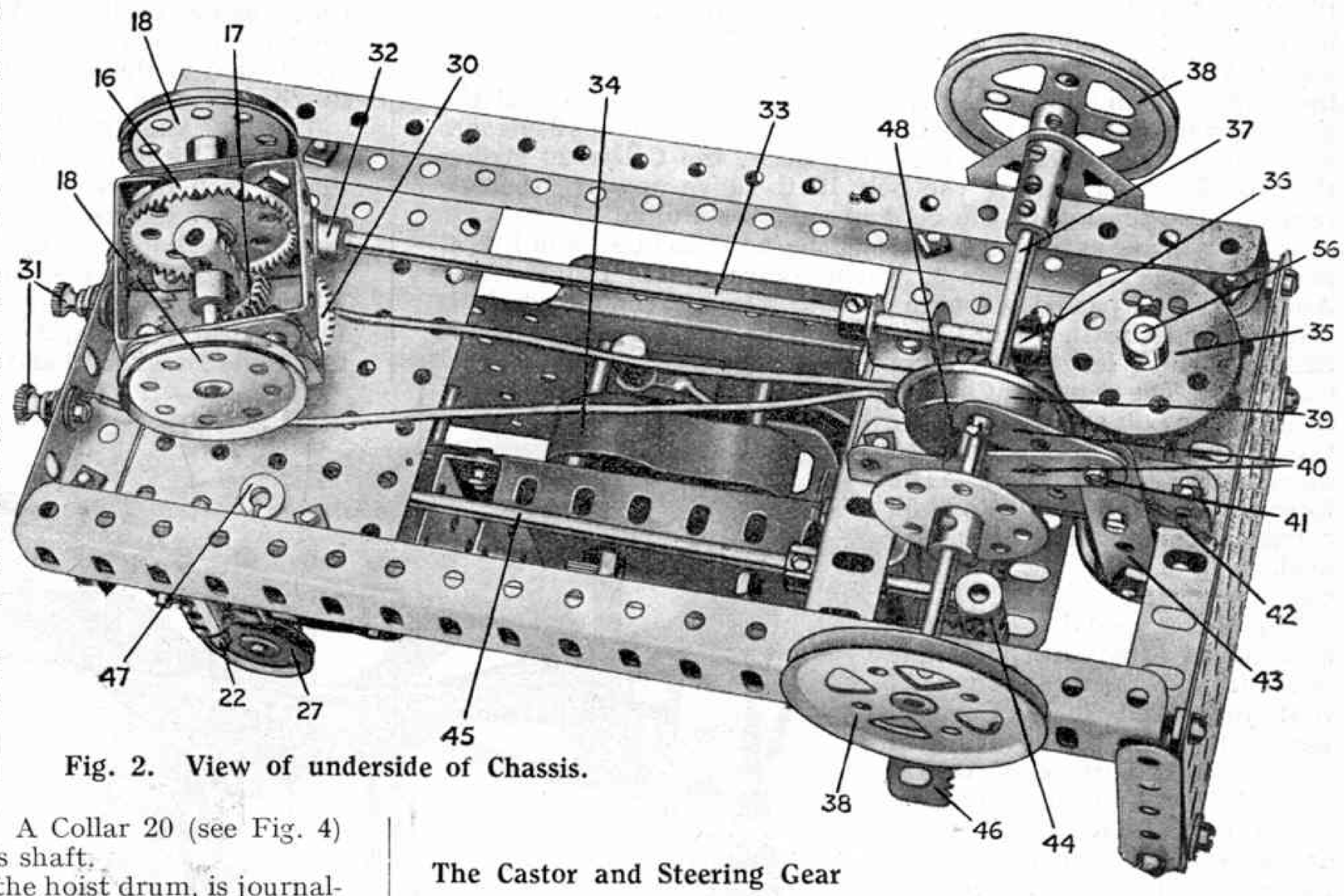


Fig. 2. View of underside of Chassis.

The Castor and Steering Gear

The underside of the Chassis, Fig. 2, shows the construction of the castor and the method of coupling the steering gear to it. The frame of the castor is composed of two $1\frac{1}{2}''$ Angle Girders to which are bolted $1\frac{1}{2}''$ Flat Girders. Two $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted between these, and the flanges of the Angle Girders are secured to the face of the 57-teeth Gear Wheel 30 by means of $\frac{3}{8}''$ Bolts, Collars being placed on the shanks of the bolts to space the Girders away from the Gear Wheel. The road axle consists of a $2\frac{1}{2}''$ Rod which carries two $1\frac{1}{2}''$ Pulley Wheels 18, the $1\frac{1}{2}''$ Contrate 16, a Coupling, and three Collars. Of the two road wheels one is fixed to the shaft, while the set-screw of the other is removed and the wheel is held in place on the end of the shaft by a Collar.

The complete castor pivots about a 2" Axle Rod that is passed through the $2\frac{1}{2}'' \times 4\frac{1}{2}''$ Flat Plate forming the floor of the gear box (Figs. 2 and 4) and is journalled in the centre hole of the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip secured between the sides of the latter (Fig. 4) and in the end of the Coupling on the road axle. The $\frac{3}{4}''$ Contrate Wheel 29 previously referred to, is secured to the upper end of this Rod and a $\frac{1}{2}''$ Pinion is slipped on to its lower portion between the Gear 30 and the Coupling.

The castor is rotated by means of a Worm 32 (Fig. 2), secured on an 8" Rod 33. This Rod is journalled at its rear end in the $4\frac{1}{2}''$ Angle Girder forming the end of the chassis frame (a $1\frac{1}{2}''$ Strip being bolted to the Girder to provide a round hole as a bearing for the Rod) while a Double Bracket provides the front journal.

A $\frac{1}{2}''$ Bevel 36 is fastened on the front end of the Rod 33 and gears with a $1\frac{1}{2}''$ Bevel 35 mounted on the Rod 56, which represents the steering column. This Rod is journalled in the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate secured to the front of the frame and also in a Double Bent Strip bolted to the Flat Plate. A $1\frac{1}{2}''$ Pulley Wheel 55 fastened to the top of the Rod 56 represents the steering wheel.

The automatic brake fitted to the hoisting shaft (see Fig. 4) consists of a 1" Pulley 27 acting as the brake drum around which a length of cord 23 is passed. One end of this cord is pushed through a hole in the chassis base plate and tied to a Washer 47 (Fig. 2) underneath the frame. The other end of the cord is fastened round the shank of a $\frac{3}{8}''$ Bolt 19 secured in the tapped hole of a Collar mounted on a 2" Rod. This Rod is journalled in a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Bracket secured to the frame of the crane, and also carries a Coupling in which is secured a 1" Axle Rod 22.

A piece of Spring Cord 21 is twisted round

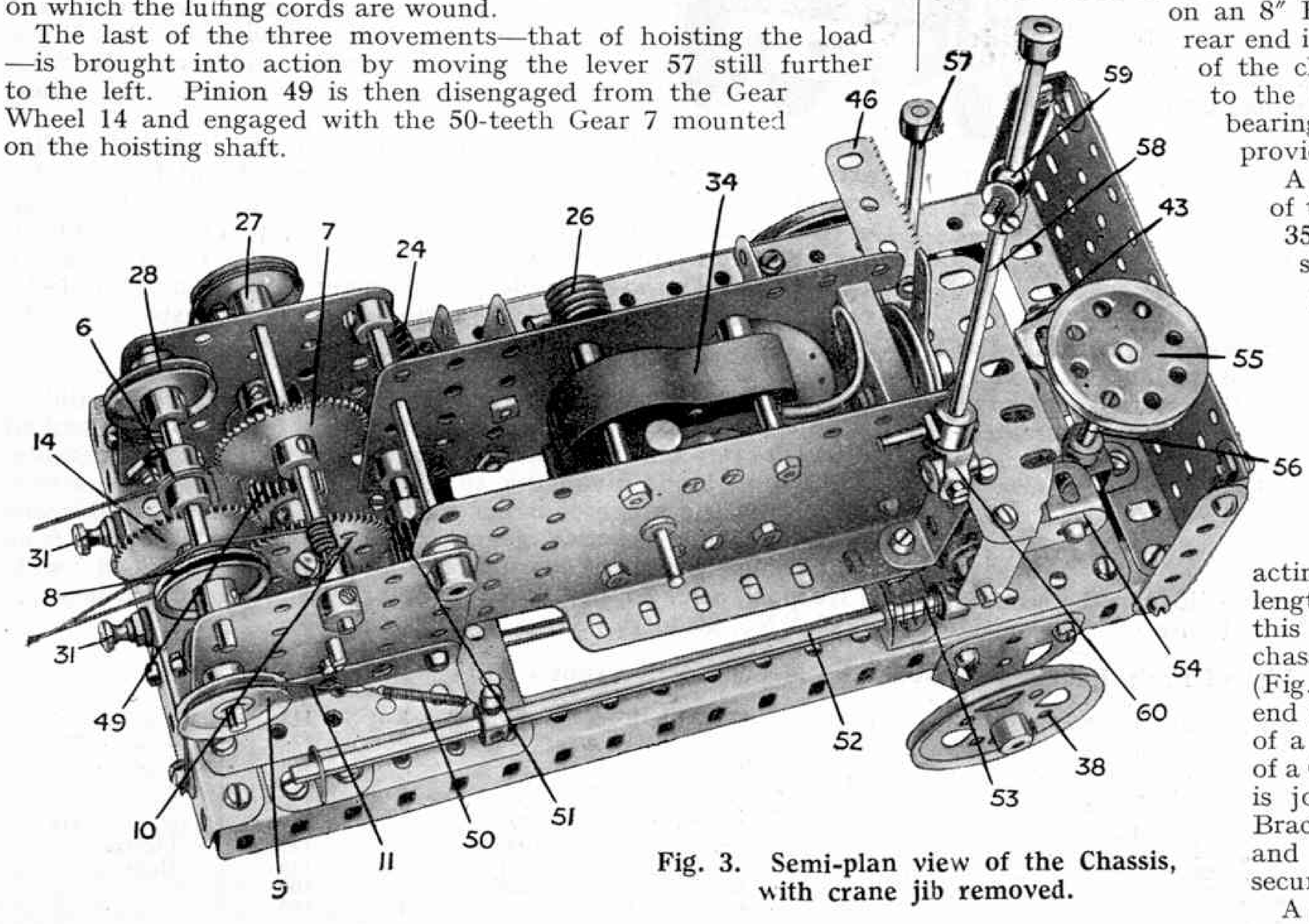


Fig. 3. Semi-plan view of the Chassis, with crane jib removed.

the Rod 22, and its other end is attached to the gear box side plate by means of a bolt and nut. The Spring 21 and Cord 23 are adjusted so that the cord is normally taut around the groove of the Pulley 27 and the brake is therefore "on." On moving the sliding primary shaft in the gear box until the ¾" Pinion 49 engages with the 50-teeth Gear on the hoist shaft, the Collar 20 strikes the Rod 22, thus causing the bolt 19 to move upward, thereby releasing the tension of the cord around the Pulley 27.

The foot brake acting on the luffing shaft 15 can be seen in Fig. 4, and comprises a 1" Pulley 9, which serves as the brake drum. Around this is passed a length of cord 11, one end of which is fastened underneath the head of the bolt 12, while the other end is tied to a short length of Spring Cord 50. The Spring Cord is secured to a bolt screwed into the tapped hole of a Collar mounted upon a 6½" Axle Rod 52. The forward end of this Rod 52 carries a Compression Spring 53 held in place by means of a Collar.

The "foot pedal" comprises a Crank 54 fitted with an Angle Bracket and mounted on a 1" Rod journalled in a Cranked Bent Strip which is attached to the under surface of the 3" Flat Girder forming the "operator's seat." The Crank is held to the 1" Rod by means of a ⅜" Bolt inserted in its set-screw hole, this bolt butting against the Collar attached to the end of the Rod 52. On depressing the "foot pedal," the Rod 52 is pushed backward against the force of the Spring 53, and the tension of the cord 11 around the Pulley 9 released. The luffing brake should only be released in this way when the luffing shaft 15 is in gear with the Motor.

The construction of the internal expanding foot brake fitted to the front axle can be seen in Fig. 2. The "brake drum" consists of a 1⅛" Flanged Wheel 39 mounted on the compound axle 37, which comprises a 4½" and a 1½" Rod joined together by a Coupling, and carries a 2" Pulley 35 at each end. Two 1½" Strips 40, each fitted with a Collar 48, form the brake shoes and are secured pivotally to the 2½" Strip 43 by a bolt 41 and two nuts, the lock-nut mechanism (S.M. 262) being employed. The Strip 43 is pivoted to a longitudinal 3" Girder fastened to the frame by a bolt and two nuts, and an Angle Bracket is secured to the upper end of this Strip to represent the "pedal."

A short length of Spring Cord 42 is attached between the bolt 41 and the frame of the model and serves to keep the brake in the "off" position. By depressing the brake pedal the Collars mounted on the Strips 40 are forced against the internal surface of the flange of the Wheel 39 and the necessary friction created. This brake, although simple, will be found remarkably efficient, only a slight movement of the foot pedal being necessary to "lock" the front axle.

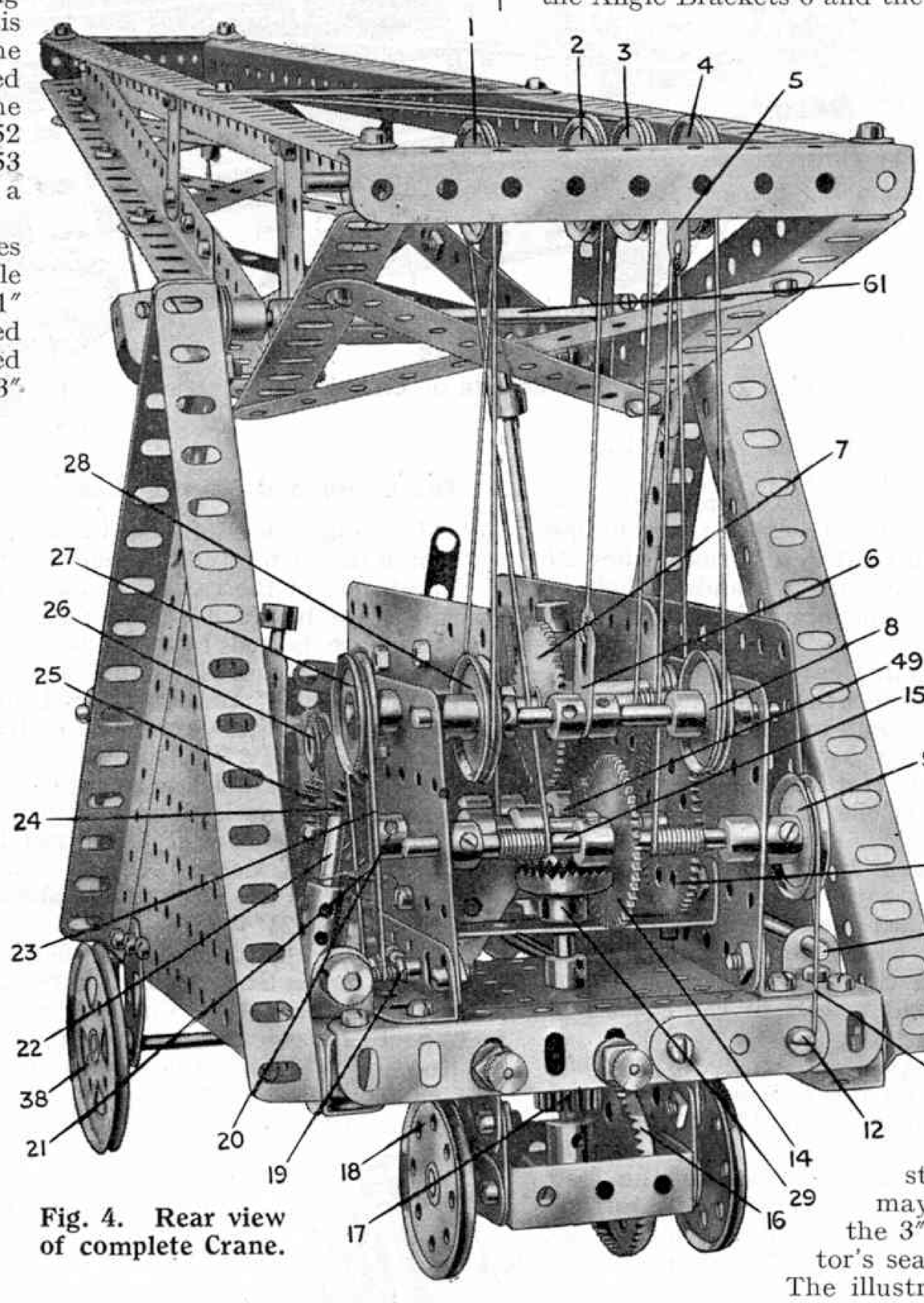


Fig. 4. Rear view of complete Crane.

General Assembly of the Crane Units

The chassis now being complete, the crane jib may be secured in place. Two 7½" Angle Girders are bolted to each side of the frame in the positions shown in Fig. 1, and are held together at their upper ends by means of 1" Triangular Plates. A Crank is also bolted to the apex of each pair of Girders to provide bearings for the jib pivot Rod 61.

The 5½" Axle 61 (Fig. 3) forms the pivot about which the jib rotates, and is passed through the top hole in each of the Triangular Plates, into the bosses of the Cranks, and also through the 2½" Flat Girders forming part of the bracing members of the jib frame. Collars are slipped on to the Rod 61 in order to keep the jib frame central with respect to its journals.

The hoisting and luffing cords may now be attached, these being shown clearly in Fig. 3. One end of the hoist cord is attached to the Angle Brackets 6 and the cord then led over the loose Pulley 2 and round a similar Pulley on the hoist block. The cord is then returned over the Pulley 3, and finally is wound round the hoist shaft and its end tied to a bolt secured in a Collar mounted on this shaft.

The luffing gear is duplicated, each cord being first attached to a Flat Bracket 5 on the Rod journalled in the jib, then passed round the Pulleys 8, 28, 1 and 4 and wound round the Rod 15. Both Cords are tied finally to the bolts secured in Collars on the shaft 15.

The automatic limit switch (see Fig. 1) should next be constructed. This consists of a 4" Axle Rod 58 connected to one arm of the reversing switch of the Electric Motor by means of a Swivel Bearing 60. Two Collars and a Handrail Support 59 are placed on this Rod at its upper end, the Handrail Support being secured to the jib in the position shown in Fig. 1.

The Collars secured to the Rod 58 must be adjusted so that as soon as the jib approaches either a perpendicular or horizontal position, the Handrail Support presses against one or other of the Collars and the arm of the reversing switch of the Motor is pushed into the "off" position, thus "cutting out" the Motor.

A Threaded Pin secured in the boss of the Swivel Bearing 60 provides a means whereby the starting and stopping of the Motor may be controlled independently from the 3" Flat Girder, which forms the operator's seat.

The illustrations of the crane included in this article show the front and rear road wheels without tyres, but a considerable improvement, both in the appearance and operation of the model, will result if Meccano Dunlop Tyres are fitted. For the front pair of wheels Meccano 2" Dunlop Tyres (part No. 142a) should be used, while 1½" diameter Tyres (part No. 142c) may be fitted to the 1½" Pulleys which form the "castor" wheels.

Special Instruction Leaflet

Model-builders should note that full instructions for building the Meccano Electric Mobile Crane may be obtained in a convenient leaflet form. This leaflet provides a really useful work of reference, and will be found invaluable to all Meccano boys who take a keen interest in the range of Super Models, and in the latest Meccano model-building practice generally. It may be obtained from any dealer, price 2d., or direct from Meccano Ltd., Old Swan, Liverpool, price 2d. post free. When ordering you should mention leaflet No. 20 in the Super Model series.

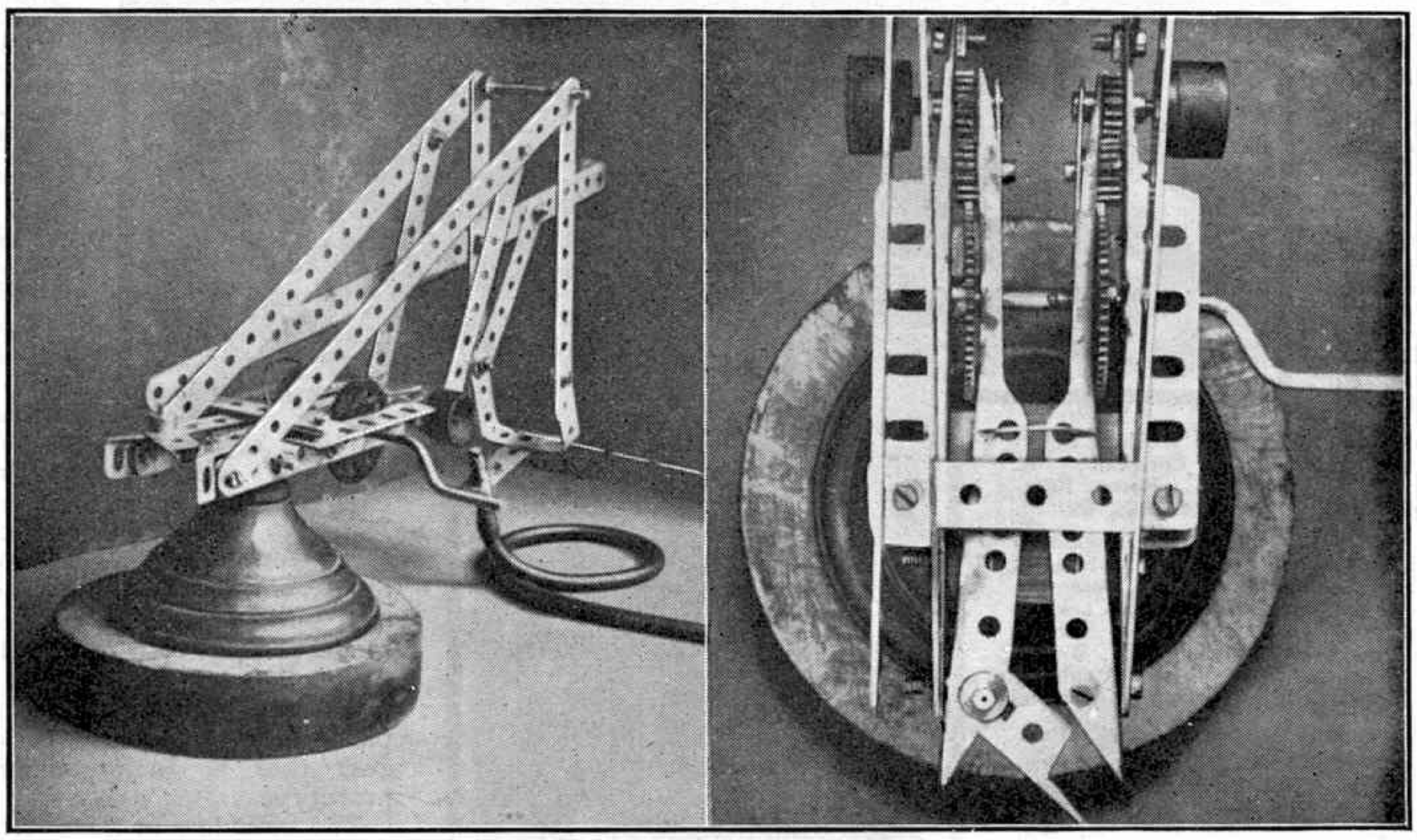
List of Parts Required to Build the Model Mobile Crane :

4 of No. 2	4 of No. 9d	2 of No. 16b	2 of No. 26	100 of No. 37	2" of No. 58	2 of No. 111a	2 of No. 302
2 „ „ 2a	1 „ „ 9e	3 „ „ 17	1 „ „ 26a	24 „ „ 38	45 „ „ 59	3 „ „ 111c	2 „ „ 303
4 „ „ 3	2 „ „ 9f	4 „ „ 18b	2 „ „ 27	2 „ „ 40	4 „ „ 62	2 „ „ 124	2 „ „ 304
4 „ „ 5	3 „ „ 10	1 „ „ 20	2 „ „ 27a	1 „ „ 44	4 „ „ 63	4 „ „ 126a	2 „ „ 305
7 „ „ 6a	8 „ „ 12	2 „ „ 20a	1 „ „ 28	1 „ „ 45	3 „ „ 72	1 „ „ 136	2 „ „ 306
2 „ „ 7a	1 „ „ 13a	3 „ „ 21	2 „ „ 30	2 „ „ 48	2 „ „ 77	1 „ „ 147a	12" „ „ 314
6 „ „ 8a	1 „ „ 14	4 „ „ 22	1 „ „ 30a	1 „ „ 48a	1 „ „ 103c	1 „ „ 147b	Electric
4 „ „ 8b	4 „ „ 15a	6 „ „ 22a	1 „ „ 30c	2 „ „ 52a	2 „ „ 103f	1 „ „ 148	Motor
4 „ „ 9	5 „ „ 16	1 „ „ 24	2 „ „ 32	2 „ „ 53a	2 „ „ 103h	1 „ „ 160	
4 „ „ 9a	4 „ „ 16a	1 „ „ 25	2 „ „ 35	1 „ „ 57	1 „ „ 110	1 „ „ 165	

Mechanical Fingers Made from Meccano

Wonderful Automatic Tube-Sealing Mechanism

IN working with radio-active materials doctors at times find it necessary to make use of very small quantities to act in restricted areas of the body. One very convenient manner of doing this is to enclose small quantities of radium emanation in very fine glass tubes, less than a millimetre in diameter, which fit inside specially prepared needles in order to assist in their introduction to the required spot. The emanation is a gaseous substance that slowly collects in a tube that contains radium, and it is also radio-active. In preparing the tubes the gas is drawn into a long piece of capillary tubing by means of a pump, and it is then only necessary to divide it into the required lengths by sealing off at measured intervals in a gas flame.



Two views of the instrument devised by Dr. Poole of the Radium Institute, Dublin, for sealing capillary tubes containing radium. The one on the left shows the framework that carries the small burner, while in that on the right may be seen the arms, formed from Angle Girders, that pull apart the portions of the tubing when sealing has been completed.

This in itself is quite a simple operation. A tube is held between the first finger and thumb of each hand and rotated rapidly in the flame. Quickly the glass is softened and the walls of the tube are fused together. The tube is then drawn out by a gentle pull, and separated into two parts. The result is, of course, the production of two sealed tubes from the original longer one. Unfortunately, radium emanation gives off rays that are liable to be harmful and to produce irritating sores on the skin of the same type as those produced by X-rays. It is advisable, therefore, to protect the hands of the operator, and various attempts have been made to do this by means of rubber gloves. These attempts have proved ineffective however, and until recently more reliance was placed on carrying out the operation quickly than on protection by gloves.

This difficulty has now been overcome by means of a simple machine for sealing off the capillary tubes. This machine was constructed by Dr. Poole of the Radium Institute in Dublin, and was described in a paper read before the Royal Dublin Society. The use of this machine ensures that adequate protection from the dangerous rays is afforded to the operator's hands by the best method of all—that of keeping the rays away from them. The apparatus also possesses the special interest of being almost entirely constructed of Meccano parts.

The two illustrations on this page give a very good idea of the working of Dr. Poole's apparatus. The one on the right shows the parts of the apparatus that replace the fingers of the operator. Inside the framework will be seen two Angle Girders from each of which a portion has been cut out in order that the ends may approach one another closely. These are pivoted in the middle and a spring forces them apart. When necessary the effect of the spring may be neutralised by means of a simple cam consisting of a pivoted strip. This may be seen at the lower end of the apparatus in the illustration.

At the other end of each of the Angle Girders are the two chucks that carry the tubing containing the radium emanation. The chucks are made of steel rod and a hole is bored through them and narrowed down at the inner end so as to form an internal shoulder. A short piece of cycle valve tubing is placed inside each of these and a screw plunger is fitted in so that by turning it the rubber is compressed with the effect of contracting the central hole. The screw plunger is also bored so that the capillary tubing may be passed through both chucks, leaving the place where the sealing is to be done in between. A Crank Handle is geared to the chucks so that the latter may be rotated at a speed of 400 to 500 revolutions per minute. When the plungers are screwed down, the tube revolves with the chucks.

The Meccano framework seen in the photograph on the left carries a swinging arm to which is attached a small gas jet. By pulling the long strip on the extreme left of the instrument the gas jet may be swung up so that the capillary tubing held by the chucks is in the flame.

The process of sealing should now be fairly clear. With the cam in position so as to bring the chucks as near together as possible, the capillary tubing is inserted and the plungers are screwed down. The Crank Handle is then rotated and the flame swung up to soften the tubing in the required place. When the tubing is sufficiently soft the cam is removed and the

(*Continued on page 380*)

Results of Meccano Model-Building Contests

By Frank Hornby

"Winter" Contest (Home and Overseas)

THE complete lists of prize-winners in the "Winter" Model-building Contest, which was announced in the Magazine for November, 1929, are as follows:—

Section A (for competitors over 14 years of age).

FIRST PRIZE, Meccano products to value £3-3s.: R. J. Whitney, Erdington, Birmingham; SECOND PRIZE, Meccano products to value £2-2s.: D. Hirst, Wakefield; THIRD PRIZE, Meccano products to value £1-1s.: E. B. Dobson, Springfield, Chelmsford.

SIX PRIZES, each consisting of a Meccano Leather Pocket Wallet: J. Neilan, New Seaham, Co. Durham; Philip D. Banks, Dunstable; B. J. Fearnley, East Molesey; Leslie Knill, Leeds; L. P. Storey, Clifton, Bristol; R. W. Blake, Twickenham.

TWELVE PRIZES, each consisting of Meccano products to value 5/-: L. Hollyoak, Coventry; W. J. Fieldhouse, Liverpool; T. Kennett, Sheerness; N. A. Hulbert, Trowbridge; C. B. Bretten, King's Lynn, Norfolk; A. N. Stenning, Ilford; A. Weldon, Peterborough; R. Barbary, Mevagessey, Cornwall; R. Chappell, Pendleton, Manchester; J. E. Rocca, Edinburgh; K. Bradford, Bristol; M. E. Edwards, Oxford.

TWELVE PRIZES, each consisting of a Meccano Engineer's Pocket Book: V. J. Taylor, Sheffield; N. Sandham, Liverpool; A. L. Hampson, Widnes; M. Robinson, Stainforth, near Doncaster; S. A. Marsh, Chester; B. G. Fletcher, Leyton, London, E.10; K. Butler, Southport; L. Todd, Harleston, Norfolk; W. Burke, Cork; E. Whatley, Manchester; B. Gibbs, Tottenham, London; Robert Edwards, St. Peters, Carmarthen.

Section B (for competitors under 14 years of age).

FIRST PRIZE, Meccano products to value £2-2s.: L. McAllen, Monymusk, Aberdeenshire; SECOND PRIZE, Meccano products to value £1-1s.: B. G. Shearing, Southampton; THIRD PRIZE, Meccano products to value 10/6: D. Cain, Watford.

SIX PRIZES, each consisting of Meccano products to value 5/-: H. H. Lewis, Pontypool Road, Mon.; K. Dixon, Romiley, Cheshire; K. Mackenzie, Belfast; R. E. G. Hooper, Southampton; L. G. Harris, Watford; James H. Rothwell, Bacup.

TWELVE PRIZES, each consisting of a Complete Instruction Manual: James A. Pendle, Trowbridge; F. Ogden, Lincoln; Harry W. Betts, West Ealing, W.13; G. P. Neilan, New Seaham, Co. Durham; P. K. Boyd, London, W.5; E. Morris, Beddau, near Pontypridd; R. H. B. Kinder, London, W.12; M. Ross, London, S.E.; Alex Kirk, Leslie, Fife; Dennis Cheshire, Hastings; K. Scotney, Andover; D. Banks, Sandown, I.O.W.

SIX PRIZES, consisting of Meccano Engineer's Pocket Books: John Watson, Bristol; A. P. Heyhurst, Failsworth, near Manchester; A. Virgo, Albourne; P. Steele, Newry, Co. Down; D. Collins, Manchester; Albert Price, Orpington, Kent.

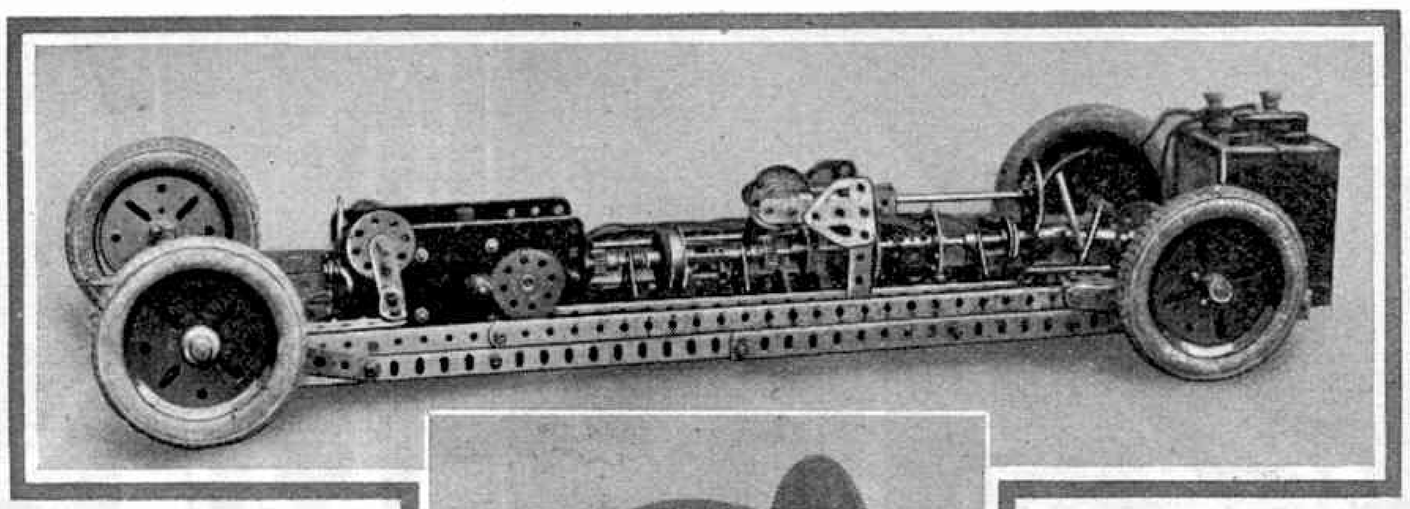
Section C (for competitors residing Overseas).

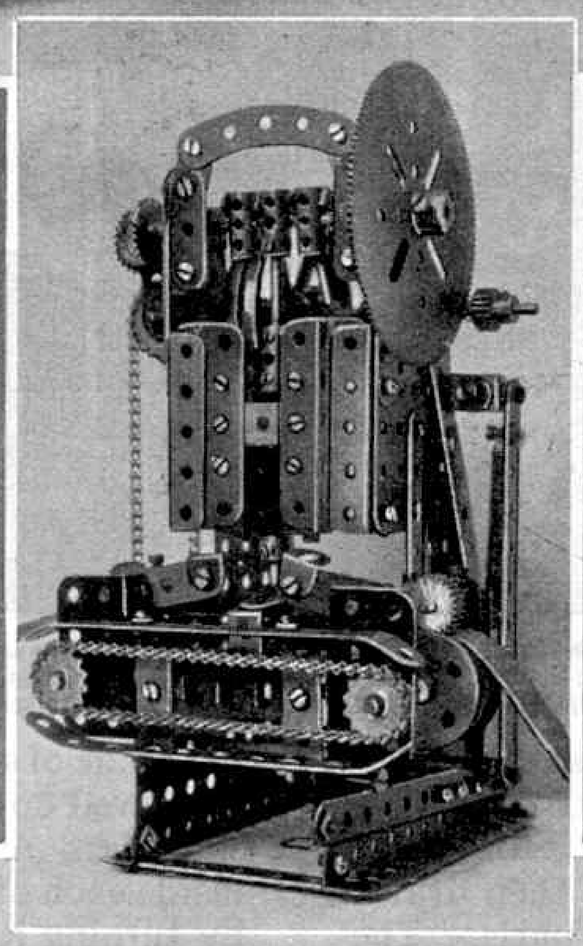
FIRST PRIZE, Meccano products to value £3-3s.: R. Wallace, Durban, Natal, South Africa; SECOND PRIZE, Meccano products to value £2-2s.: C. M. Olie, Haarlem, Holland; THIRD PRIZE, Meccano products to value £1-1s.: F. Underdown, Crows Nest, North Sydney, Australia.

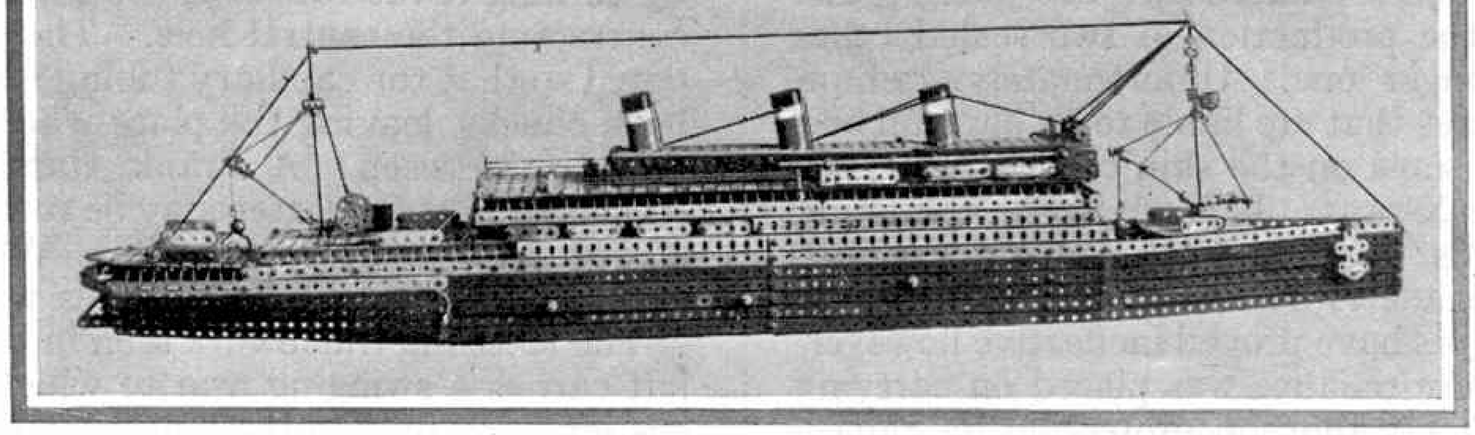
SIX PRIZES, each consisting of a Meccano Pocket Wallet: K. Aboul-Zahab, Beyrout, Syria; H. Nelson Eustis, Alberton, Australia; E. Bridgland, Calgary, Alberta, Canada; Douglas Pike, Witbank, Transvaal, S. Africa; C. Cairs, Cape Town, South Africa; Alfred Venus, Montreal, Canada.

TWELVE PRIZES, each consisting of Meccano products to value 5/-: F. Pantanella, Rome, Italy; R. Himburg, Dunedin, New Zealand; H. Wilmot, Walmer, Port Elizabeth, South Africa; E. Worthington, Vancouver, B.C.; G. Bevan, Montreal, Canada; M. Crorie, Roslyn, Dunedin, New Zealand; W. Bolitho, Castle Hill, Australia; W. Scott, Malvern, Australia; A. Lewis, Rondebosch, Cape Town, S. Africa; D. Murray, Rondebosch, South Africa; Jack Tanner, Annandale, Sydney, Australia; A. Thiele, Oderne, Denmark.

TWELVE PRIZES, each consisting of a Meccano Engineer's Pocket Book: Tony MacLachlan, Dunedin, New Zealand; M. Rankin, Toorak, Melbourne, Australia; E. Williamson, Fielding, New Zealand; H. Mooij, Nijmegen, Holland; E. Bode, Edgecliff, Sydney, Australia; C. J. McCain, Leichardt, Sydney, Australia; D. G. Mills, Durban, Natal, South Africa; K. Tanner, Johannesburg, S. Africa; Z. Sandrino, Trento, Italy; E. P. Hincks, Ontario, Canada; C. Fearnley, Otaki, New Zealand; S. F. Desai, Navsari, India.







Top: An interesting model of the famous "Golden Arrow" racing car, by D. Cain. Centre: Model Roller-Feed Press constructed by D. Hirst. Bottom: The s.s. "Leviathan" reproduced in Meccano by B. G. Shearing.

The First and Third Prizes in Section A were secured by R. J. Whitney and E. B. Dobson respectively for model locomotives, Whitney's model being a replica of a 2–8–2 engine of the type used on the Indian State Railways, while Dobson chose a typical 4–4–0 type express passenger engine as the prototype of his model. Although both locos are very well built preference was given to Whitney's model owing to the slightly more accurate proportions of the various units and to the fact that Whitney had taken considerable pains in reproducing the Walschaerts' valve gear that is an important feature of the prototype.

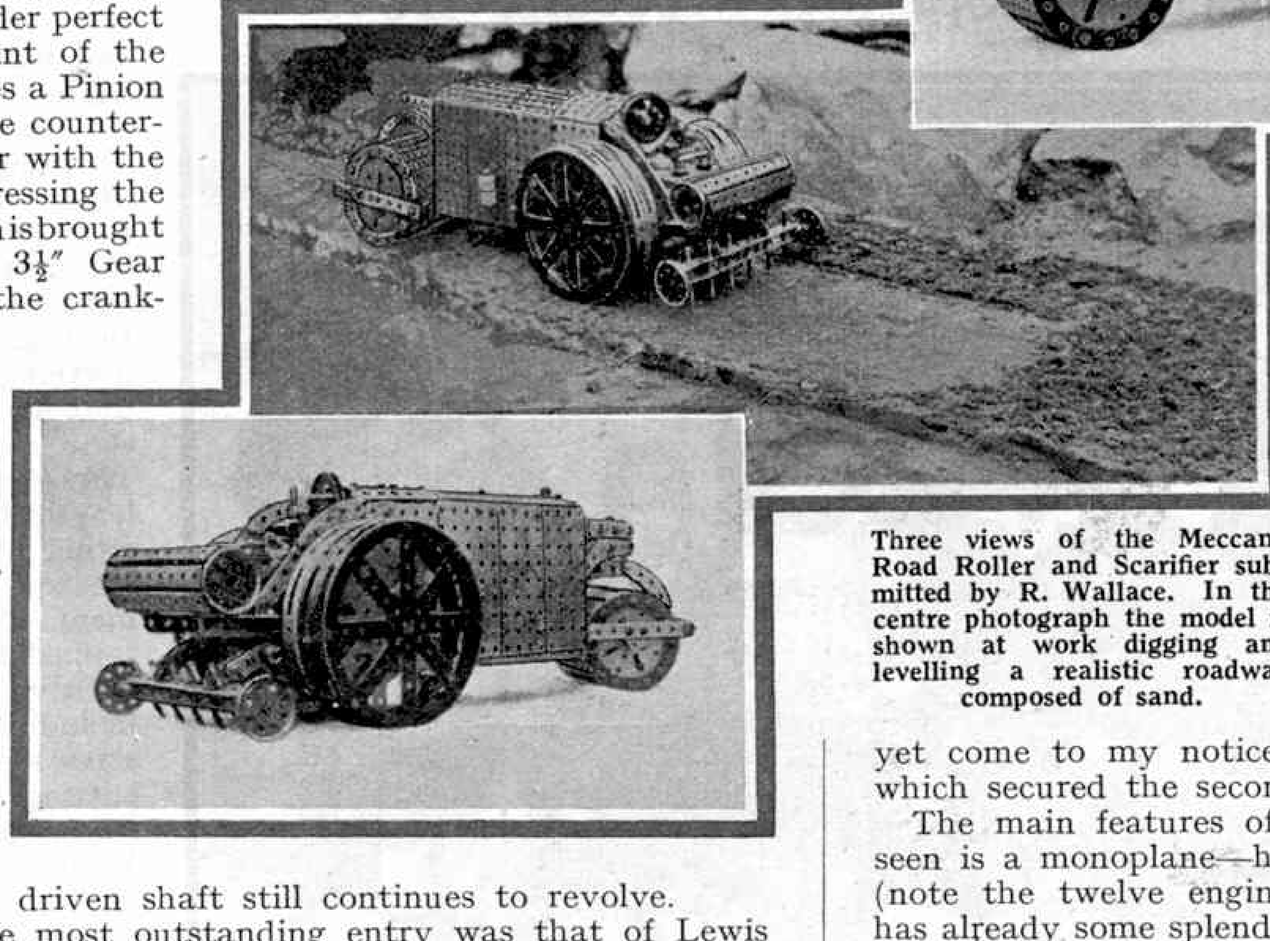
The cylinders in his model are formed from Sleeve Pieces, ¾" Flanged Wheels and 1½" Flat Girders, and the valve chest of each cylinder comprises two Couplings attached to the Flat Girders by bolts on which Washers are placed for spacing purposes. A business-like "cowcatcher" is formed from two Windmill Sails bolted together, and the steam dome is admirably represented by a Cone Pulley sunk partially below the upper surface of the boiler, the latter being composed from a number of 12½" Strips. The model is driven by an Electric Motor, the current for which is supplied from a Collecting Shoe, that is located under the eight wheeled tender and is in contact with the "live" rail placed between the running rails.

While Whitney's model possesses all the grace and sweeping lines of an actual express locomotive, Dobson's model presents a totally different but equally realistic appearance with its short, squat, and solid construction. It is driven by a Clockwork Motor housed in the boiler and, by an ingenious "trip" arrangement placed between the running rails, the Motor may be automatically reversed (for the benefit of readers who may be interested in

methods of automatically reversing model engines, it may be mentioned that a suitable "trip" device was fully illustrated and described in the "Suggestions Section" of the November, 1925, "*M.M.*").

It is interesting to note that Dobson proposes to construct a number of Meccano trucks and wagons for use with his engine.

Consideration of space permits mention of only one more model from Section A. Donald Hirst, winner of the Second Prize, submitted a working model of a roller feed press, which is particularly remarkable on account of its "clean" construction and the evident care with which each part was built. The model represents a machine used to punch holes in strips of metal and although it is not capable of working with real metal it will, nevertheless, punch holes in a band of paper with great precision and rapidity. The punching die is operated from a crankshaft driven from the main driving shaft, and the band of paper passes between driven rollers, which feed it forward as the punching proceeds. A foot-operated clutch which is provided so that the press is under perfect control at any point of the die stroke, comprises a Pinion carried on a slidable countershaft that is in gear with the main drive. On pressing the foot lever this Pinion is brought into mesh with a 3½" Gear Wheel secured to the crankshaft that operates the die. The Pinion remains in mesh only so long as the lever is depressed. When the lever is released the pressure of a Spring disengages the Pinion from the 3½" Gear and the die crankshaft is brought instantly to a standstill, although the main driven shaft still continues to revolve.



Three views of the Meccano Road Roller and Scarifier submitted by R. Wallace. In the centre photograph the model is shown at work digging and levelling a realistic roadway composed of sand.

In Section B the most outstanding entry was that of Lewis McAllen, who conceived the original idea of building a Meccano replica of the old Norman Church at Moneymusk, Aberdeenshire. The result is an excellent example of the adaptability of Meccano parts to architectural model-building, and I hope to illustrate it in a forthcoming special architectural article in the "*M.M.*"

B. G. Shearing's model ship illustrated herewith took the Second Prize in this Section. The model represents the United States Shipping Lines' famous vessel s.s. "*Leviathan*," and it will be obvious to all boys who are familiar with the actual ship that the grace and power suggested by its appearance is reflected to a large extent in the model. The detail work, such as the deck fittings, etc., has been carried out with considerable dexterity and fidelity to the prototype. Shearing may well be proud of his handiwork.

Motor cars are such popular subjects with Meccano boys that little outstanding interest attaches to the majority of such models. An exception, however, is to be found in D. Cain's attempt to model the chassis of the well known racing car, "Golden Arrow." The constructional details have been worked out particularly well, and extreme care has been exercised in assembling the clutch, gear box, and steering gear.

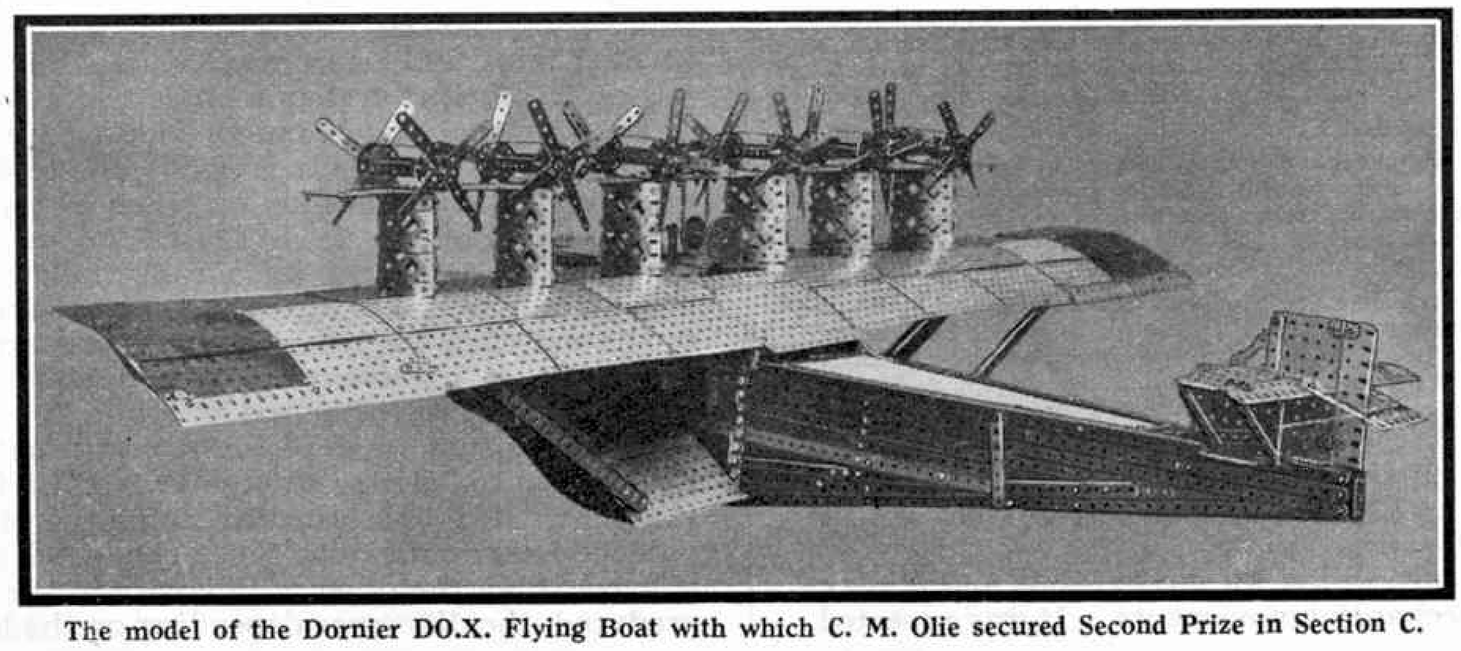
An American type road roller secured the biggest prize in the Overseas Section. The model, which is the work of R. Wallace and is illustrated herewith, is driven by an Electric Motor, the drive being taken via a clutch, two speed gear box and differential, to the road wheels. Each axle of the differential carries at its outer end a ½" Pinion, which drives a 133-tooth Gear Wheel that is secured to the centre one of three Hub Discs that are bolted together to form the driving wheel. The steering system is novel, and consists essentially of a ¾" Contrate that is secured to the lower end of the steering column and engages a ¾" Pinion. On the axle of this Pinion is a Worm which, in turn, engages the teeth of a Rack Segment bolted to the framework of the front roller. On turning the steering column the roller is moved either to the right or the left. The Motor is supplied with current from an accumulator carried in a special compartment situated between the rear road wheels, so that advantage may be taken of its weight to give extra adhesion. In the photographs the model is shown actually at work on a "road"—the surface of which consists of sand. The scarifier is operated from the driver's seat and may be raised or lowered at will.

A few months ago some sensation was caused by the news that a flying boat carrying no less than 169 persons had made a successful flight. This huge aircraft, named the "Dornier DO.X.," is the world's largest flying boat. It was fully described and illustrated in the "*M.M.*" for December, 1929, and several Meccano boys have made attempts to reproduce the enormous machine in Meccano. One of the most successful and certainly the most interesting attempt that has yet come to my notice is the fine model illustrated herewith, which secured the second prize for C. M. Olie.

The main features of the actual machine—which, as will be seen is a monoplane—have been well brought out in the model (note the twelve engines on the main wing). The "DO.X." has already some splendid feats to its credit, amongst which may be mentioned its ability to "take off" with a load of 45 tons in little more than 60 seconds, and its speed of 134 m.p.h.

The immense growth of traffic both by road and rail in recent times has resulted in the building of enormous bridges in all parts of the world. It is not surprising, therefore, to find amongst the entries in a Meccano competition one or two examples of the bridge-builders' art.

I have in mind an entry from Francis Underdown, who secured the Third Prize in Section C. His model is a replica in miniature of the enormous arch bridge now growing inch by inch across the harbour at Sydney. When completed, this will be the world's largest bridge—a triumph indeed for the engineers who designed and built it. Underdown is specially favoured in living in Sydney, where he is able to obtain first-hand knowledge of the actual bridge. His model is constructed finely and resembles the real structure in practically every important detail. The ribs of the great arch are reproduced from a number of short Strips and Curved Strips bolted end to end, and the tie rods supporting the roadway are formed from longer Strips of various lengths. The shore piers are solidly-built from Angle Girders, the sides being filled in with Braced Girders. Underwood is not yet 10 years of age so it should be a source of great satisfaction to him to have built so excellent a model thus early in his model-building career.



The model of the Dornier DO.X. Flying Boat with which C. M. Olie secured Second Prize in Section C.

An electrically operated telpher crane attracted the judges' attention and secured an award for K. Aboul-Zahab. The mechanism of the trolley-hoist includes four clutches, each of which controls one of the different movements of which the model is capable.

Results of Meccano Competitions—(*Continued*)

First, Second, and Third "Mechanism Contests (Home Sections)

Each of the three "Mechanism" Contests proved very popular with Meccano boys and many ingenious and cleverly thought-out contributions were received.

In entering the first Contest of the series readers were asked to submit either complete models or sections of models incorporating any form of screw gear as the principal feature. The object of the second contest was chiefly to test the ingenuity of competitors in designing various forms of brake gear suitable for retarding or stopping a machine, motor, or other moving body.

In the third contest, competitors were asked to devise a mechanism that would connect together two pistons moving simultaneously in a cylinder, the one piston having a stroke of 3″ and the other one of 4″. The mechanism had to be so arranged that both pistons moved simultaneously in opposite directions. Many of the entries in this contest were extremely interesting and surprisingly ingenious, so that the judges had a most difficult task in placing the various awards. No less than six competitors tied for the First Prize and after very careful consideration it was decided to combine the original First, Second, and Third Prizes and to divide the total amount equally amongst the six competitors. The full lists of prize-winners in each of the three contests are as follows:—

First Mechanism Contest (Home Section)

FIRST PRIZE, Meccano products to value £1-1s.: A. M. Johnston, Dunstable; SECOND PRIZE, Meccano products to value 15/–: H. H. Lewis, Pontypool Road, Mon. THIRD PRIZE, Meccano products to value 10/6: J. F. Hady, Ilford.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: G. Kerley, London, N.W.10; John Watson, Bristol; F. A. Webster, Guiseley, near Leeds; J. Appleton, Croydon, Surrey; William Burke, Cork; Kenneth Walton, Penwortham, near Preston; Robert Philip, Brechin; E. Morris, Beddau, near Pontypridd; Charles Evens, Peacehaven; V. C. Kaile, Mayford; Fred Bearne, Grantham; J. U. Balfour, Wolverhampton.

Second Mechanism Contest (Home Section)

FIRST PRIZE, Meccano products to value £1-1s.: Alister Lonnon, Kensington, London, W.8. SECOND PRIZE, Meccano products to value 15/–: E. Moss, Wembley. THIRD PRIZE, Meccano products to value 10/6: C. L. Redshaw, Spalding.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: Charles Hodges, Lichfield, Staffs.; Ernest Bailey, Freemantle, Southampton; A. C. Masterman, London, N.W.1; J. Coombes, Birmingham; J. E. Harris, Marden, Kent; George Laidlaw, Edinburgh; R. Horsham, Hornchurch, Essex; E. Powell, Hammersmith, London; H. Thompson, Everton, Liverpool; B. Unné, Harrogate; E. H. Stradling, Usk, Mon.; W. Raybould, Boxwich, Walsall.

Third Mechanism Contest (Home Section)

The FIRST, SECOND, and THIRD PRIZES have been combined and divided equally among the following competitors, each receiving Meccano products to value 8/–: David Norton, Streetly, near Birmingham; Adam Dunlop, Riccarton, Kilmarnock; L. Matthews, Horfield, Bristol; R. Powell, Keyham, Plymouth; Fred Miller, Oldham; C. Pegg, Winshill, Burton-on-Trent.

TWELVE PRIZES, each consisting of a Meccano Engineers' Pocket Book: S. Broadhurst, Bishop Auckland, Co. Durham; J. P. T. Bennett, Buckhurst Hill, Essex; J. V. Glynn, St. Annes, Dublin; R. Permentiers, Edgware, Middlesex; P. Scott, Southsea; Arnold Hood, Ipswich; James Huson, London, S.E.19; J. R. Lansley, Upper Warlingham; E. Jeffrey, Tantolie, Newcastle-on-Tyne; V. G. Welsby, Cardiff; L. Jones, Rochdale; P. Morris, Kensington, London, W.

One or two of the best entries from each contest will be dealt with in future issues of the "*M.M.*," so for the present a brief general commentary must suffice.

The screw is one of the earliest known mechanisms and it plays a very important part in mechanical movements. It was expected, therefore, that the entries in the first contest would be very varied in character and the result proved this to be the case.

The First Prize was awarded for an ingenious device designed to synchronise the speed of two electric motors, even though one of the motors is slightly more powerful than the other. A cleverly designed screw mechanism, for operating the feed carriage on a bacon slicing machine, secured the Second Prize for H. Lewis, while J. F. Hady, winner of the Third Prize, submitted a screw-operated device for automatically opening or closing hinged windows or fanlights, etc., from a distance.

Charles Evens' model, although of a very simple nature, was well thought-out and constructed. It consists of a shoe stretcher and makes use of a Sector Plate attached by means of a Collar to one end of a Threaded Rod. To the other end of the Rod a Flat Trunnion is connected, by means of a "spider" extracted from a Swivel Bearing, to represent the portion of the stretcher that fits into the toe of the shoe. On turning the Threaded Rod the overall length of the stretcher is either increased or decreased, owing to the movement of the Rod in the tapped holes of the spider.

Other outstanding entries include a model of the lead-screw mechanism of a screw-cutting lathe, entered by F. Bearne, a bench vice by V. C. Kaile, and a semi-automatic motor car wind screen wiper by John Watson.

One of the most interesting entries in the second Contest came from A. Lonnon who devised a brake applicable to a slow-moving vehicle, such as a horse-drawn lorry, and made excellent use of $\frac{5}{8}$″ Rubber Rings to form the brake shoes. The device acts simultaneously on two pairs of wheels and follows very closely the brake gear illustrated in the Contest announcement on page 957 of the December "*M.M.*" On turning a handwheel formed from a Bush Wheel and Threaded Pin, a Screwed Rod is caused to operate a system of toggles to which the brake shoes are attached.

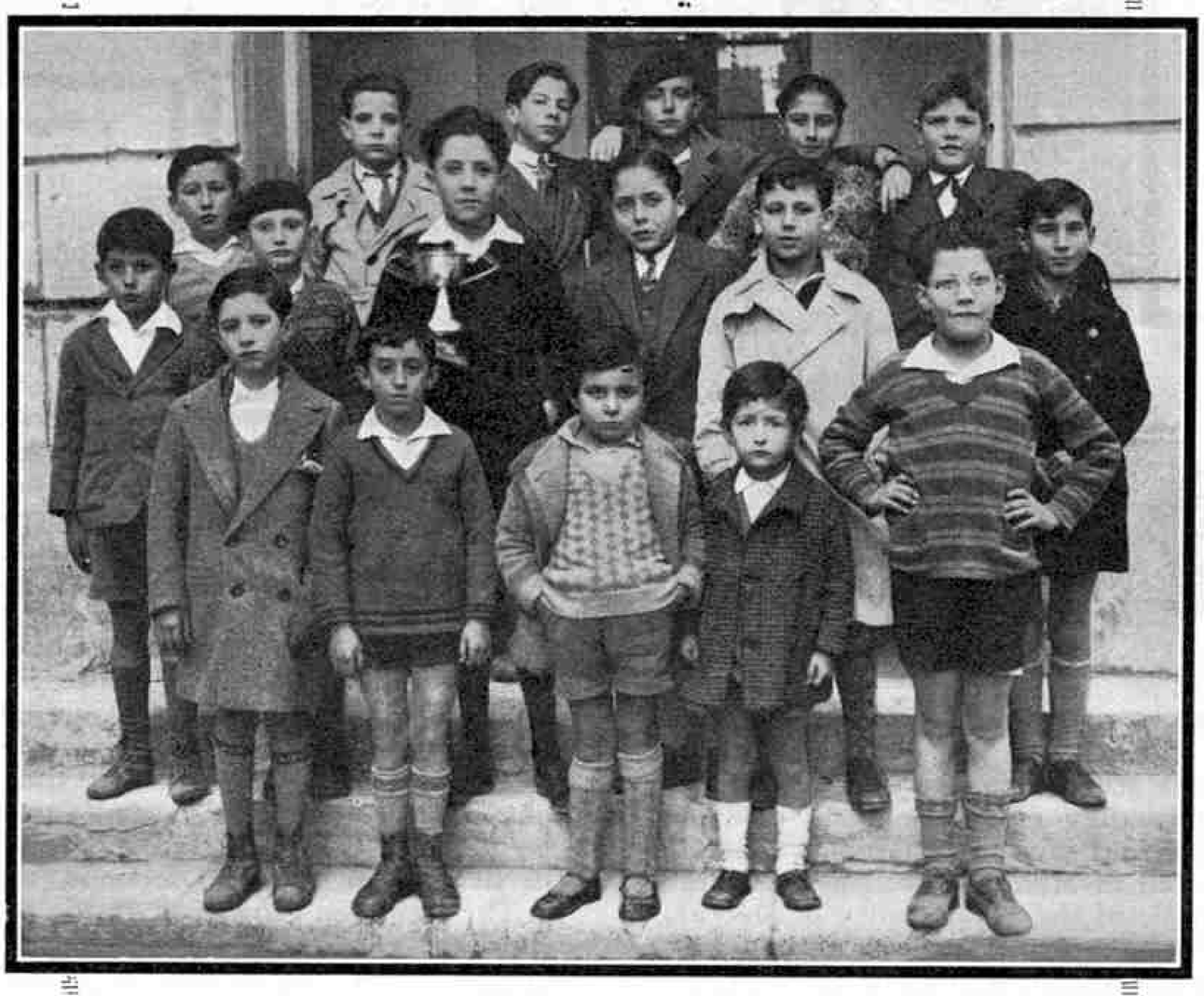
Of the three contests the third proved the most popular and some very ingenious solutions to the problem that appeared on page 38 of the January "*M.M.*" were submitted. The majority of competitors solved the problem by various arrangements of pivoted links, but one or two elected to use a more complicated but quite efficient system of rods and gearing.

The principal prize-winners adopted similar methods in solving the problem and since it is impossible to describe each entry, the following explanation may be taken as representative of them all.

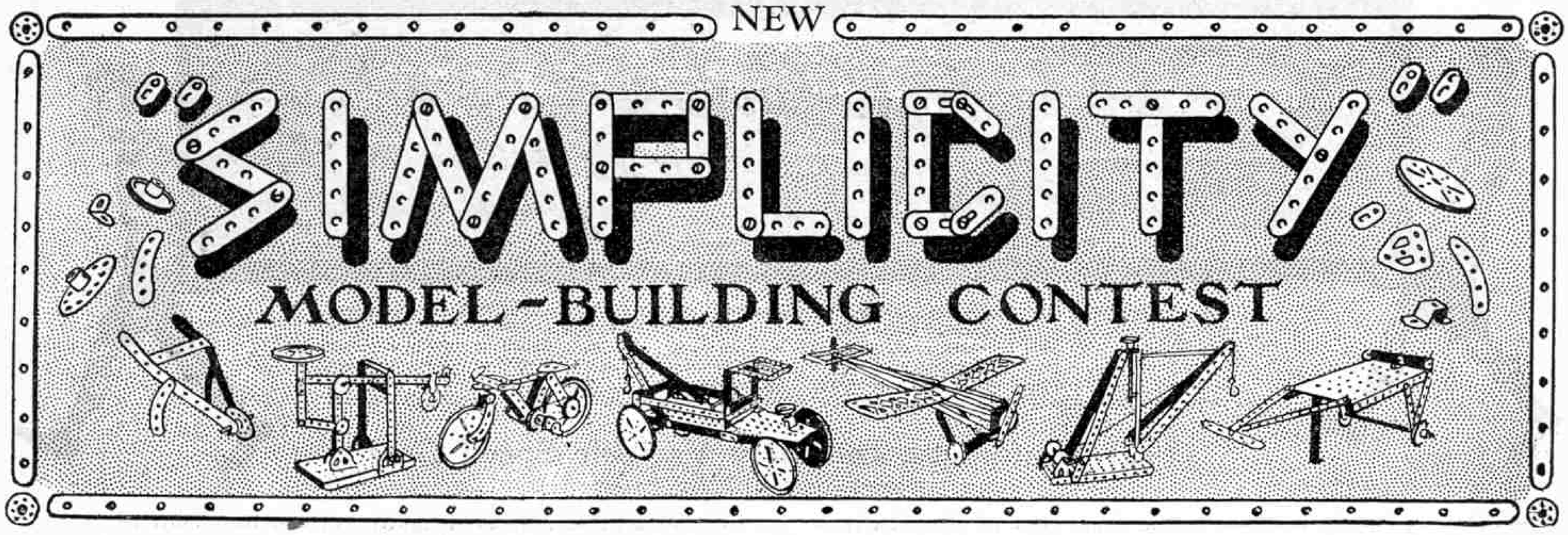
The rod of piston A (see illustration on page 38 of the January "*M.M.*") is connected by a short link to a second rod that is pivoted on one side of the cylinder, its fulcrum being nearer one end of the rod than the other. The longer arm of the pivoted rod is connected at its extremity to a further rod, the other end of which is attached to the rod of piston B.

It follows that when piston A moves outward, the short arm of the pivoted rod is caused to move to the left and the longer arm to the right. The link attached to the rod of piston B thus tends to pull the latter outward. Since one of the arms of the pivoted rod is longer than the other a difference in the stroke of the pistons is produced, the difference depending on the length ratio of the arms.

Successful Spanish Meccano Boys



The illustration shows a group of prize-winners in a recent Meccano model-building contest organised by Sig. D. Gabrial Avia of Figueras, Spain. The contest attracted considerable interest in the locality and was admirably supported by the Corporation, local colleges, and several business concerns, who assisted in defraying the expenses of the contest and the cost of prizes. Entries ranged from a model of a windmill to a realistic replica of a modern cage-winding gear as used in mines, and included cranes of all types, motor cars, a loom, and a fine original model Meccanograph. All the boys shown in the photograph were the lucky and proud recipients of prizes and they are to be congratulated on their model-building skill.



BIG PRIZES FOR SMALL MODELS

FULL details of the Third "Simplicity" Competition were published in the March issue of the "*M.M.*," but we are again including them so that any readers who did not see the previous announcement may have an opportunity of competing while there is still time. Entries in the Home Sections must be received by 31st May, while the closing date for the Overseas Section is 31st July.

In this contest prizes are offered for the most ingenious models constructed from the smallest possible number of parts. More than one model may be entered in the competition, but all entries from any single competitor must be sent under the same cover. The prizes are shown in the accompanying list.

It is a perfectly simple matter to enter the competition, for there are no entrance forms to fill in or fees to be paid. It is only necessary to set to work and build a simple yet realistic model, and then either take a photograph of it or make a good drawing and enclose it in an envelope addressed to "Third Simplicity" Model-building Contest, Meccano Ltd., Old Swan, Liverpool.

Competitors must take care to see that their age, name and full address appear on the back of each photo or sheet of paper sent.

Photographs or drawings need not be the competitor's own work but the model itself must be entirely the result of the competitor's own unaided efforts. Entries will be divided into three sections as follow: Section A, for boys or girls over 14 years of age residing in the British Isles; Section B, for boys or girls under 14 years of age residing in the British Isles; Section C, for Overseas readers of all ages.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follow:–

First Prize: Cheque for £2-2s.
Second Prize: Cheque for £1-1s.
Third Prize: Cheque for 10/6.
Twelve Prizes, each consisting of Meccano products to value 5/–.
Twelve Prizes, each consisting of a Meccano Engineers' Note Book.

The Prizes in Section B are as follow:—

First Prize: Meccano products to value £1-1s.
Second Prize: Meccano products to value 10/6.
Third Prize: Meccano products to value 7/6.
Twelve Prizes, each consisting of a complete Instructions Manual.
Six Prizes, each consisting of a Meccano Engineers' Note Book.

A limited number of Certificates of Merit will be awarded in each Section.

HAVE YOU ENTERED THE "APRIL" CONTEST?

We take this opportunity to remind readers that the Home and Overseas Sections of the "April" Model-building Contest are still open for entries. Full details of the contest were published in last month's "*M.M.*," and for the benefit of any readers who did not see the previous announcement we are repeating it this month. To enter this contest it is only necessary to think of a new model and construct it as neatly as possible. Then either take a photograph of it or make a good drawing, and enclose it in an envelope addressed to "April" Model-building Contest, Meccano Ltd., Old Swan, Liverpool.

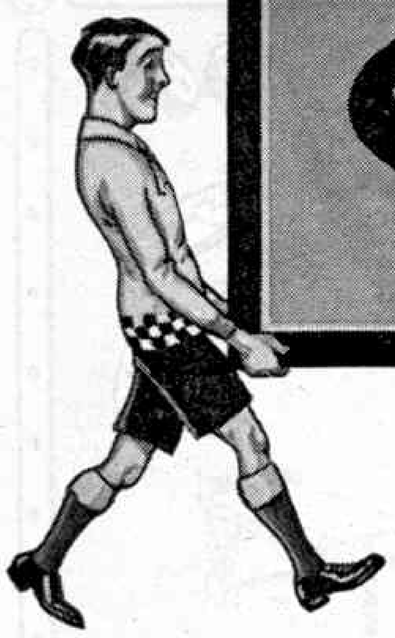
Take care to write your age, name and full address clearly on the back of each photo or drawing submitted.

Entries will be divided into three Sections as follow: Section A, for readers residing in the British Isles and over 14 years of age; Section B, for readers residing in the British Isles and under 14 years of age; Section C, for readers of all ages residing Overseas. The principal prizes in both Sections A and C are as follow: First Prize, cheque for £2-2s.; Second Prize, cheque for £1-1s.; Third Prize, cheque for 10/6. Twelve Prizes, each consisting of Meccano Goods to value 5/–. Twelve Prizes, each consisting of a copy of "Famous Trains." The prizes in Section B are as follow: First Prize, cheque for £1-1s.; Second Prize, cheque for 10/6; Third Prize, cheque for 7/6. Six Prizes, each consisting of Meccano goods to value 5/–. Twelve Prizes, each consisting of a complete Instructions Manual. In addition a number of Consolation Prizes and Certificates of Merit will be awarded in each Section.

Closing dates, for Sections A and B, 31st May; for Section C, 30th August, 1930.

"Lister Truck" Model-Building Competition

Model-builders residing abroad should remember that the Overseas Section of the Meccano "Lister Truck" Competition is still open. This Section closes on the 31st July, so there is still time for many Overseas readers to send in their entries. Full details of the Contest were published in the March issue of the "*M.M.*"



Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(192)—Automatic Infinitely Variable Speed Gear

(J. Bennett, Buckhurst Hill, Essex)

TO effect a change of speed in the usual type of gear box it is necessary to slide certain gears into or out of mesh by means of a lever, thus changing the ratio between certain shafts. This method has many disadvantages, apart from its complexity and the skill necessary for its operation, and many ingenious devices have been invented from time to time in an effort to replace it. Particular attention has been paid to motor car gear boxes, and there are now several mechanisms in existence that enable changes of speed to be carried out automatically or semi-automatically.

Several such mechanisms have been described from time to time in the Suggestions Section, and the apparatus shown in Fig. 192 is a further example. It embodies what is known as "friction disc" drive transmission. This type of transmission gear was clearly demonstrated in a model that appeared in the "Suggestions Section" for July, 1926, but for the benefit of those readers who are unable to refer to that number we may explain that it depends for its operation upon the friction existing between two discs, one revolving upon, and at right angles to, the other.

By sliding the driven disc towards or away from the centre of rotation of the other, the speed is decreased or increased. For example, when the driven disc is pressing upon the other at a point near the latter's circumference, i.e., at the farthest permissible point from the driving shaft, the driven disc will rotate at maximum speed. If now the latter is advanced towards the centre of the driving disc, its speed must automatically decrease. In the earlier model, a reverse movement was provided, merely by moving the driven disc from one side of the driving disc to the other. Also the change in speed was effected by operation of a hand lever, whereas in the present example the change is brought about by a centrifugal governor, so that the speed ratio varies automatically according to the resistance that is to be overcome.

The construction of the mechanism, as shown in Fig. 192, should be fairly clear. The driving shaft 2, which is connected by any suitable means to the Motor, carries a Face Plate, and is journalled freely in two Corner Brackets that form part of the frame. A 6½" Rod 3 is free to slide in its bearings and is fitted with a 1" fast Pulley 7, which is fitted with a 1" Rubber Ring that engages with the surface of the Face Plate and is kept in close contact therewith by a Compression Spring on the Rod 2.

The centrifugal governor consists of two Bush Wheels 4 and 5, to each of which two Double Brackets are bolted rigidly. The links carrying the governor weights are attached pivotally to the Double Brackets by means of lock-nutted bolts (see Standard Mechanism No. 262), and are passed on to 1½" Rods, on which are mounted the 1" Gears forming the governor weights. Short lengths of Spring Cord, attached to the links in the position indicated in the illustration, tend to prevent the governor functioning at too low a speed and also to return it to normal after operation.

The Bush Wheel 4 is secured to the Rod 3, but the Bush Wheel 5 is free thereon and is connected by a Socket Coupling to a ½" diam. ½" wide Pinion. A Threaded Pin 6, by engaging the groove of the Socket Coupling, prevents longitudinal movement of the Bush Wheel 5. The Pinion is in constant mesh with a 57-teeth Gear Wheel that is secured rigidly to the driven shaft 1.

The model functions in the following way: Assuming the shaft 1 to be running free without any retarding effect, the governor weights will fly out to their fullest extent owing to the centrifugal force that is developed by the speed of the rotating shaft 3. Since the Bush Wheel 5 cannot move longitudinally, wheel 4 must do so, carrying with it the Rod 3. This will result in the Pulley 7 being kept near the periphery of the Face Plate, and a step-up ratio is obtained.

When a retarding force is applied to the shaft 1, the speed of the Rod 3 diminishes and the governor weights fall inward, thus moving the Rod 3 and pushing the 1" Pulley 7 nearer the centre of the Face Plate. As the resistance on the shaft 1 increases so will the Pulley move nearer the centre of the Face Plate, thus compensating for the extra load by increasing automatically the reduction ratio between the shafts 2 and 3.

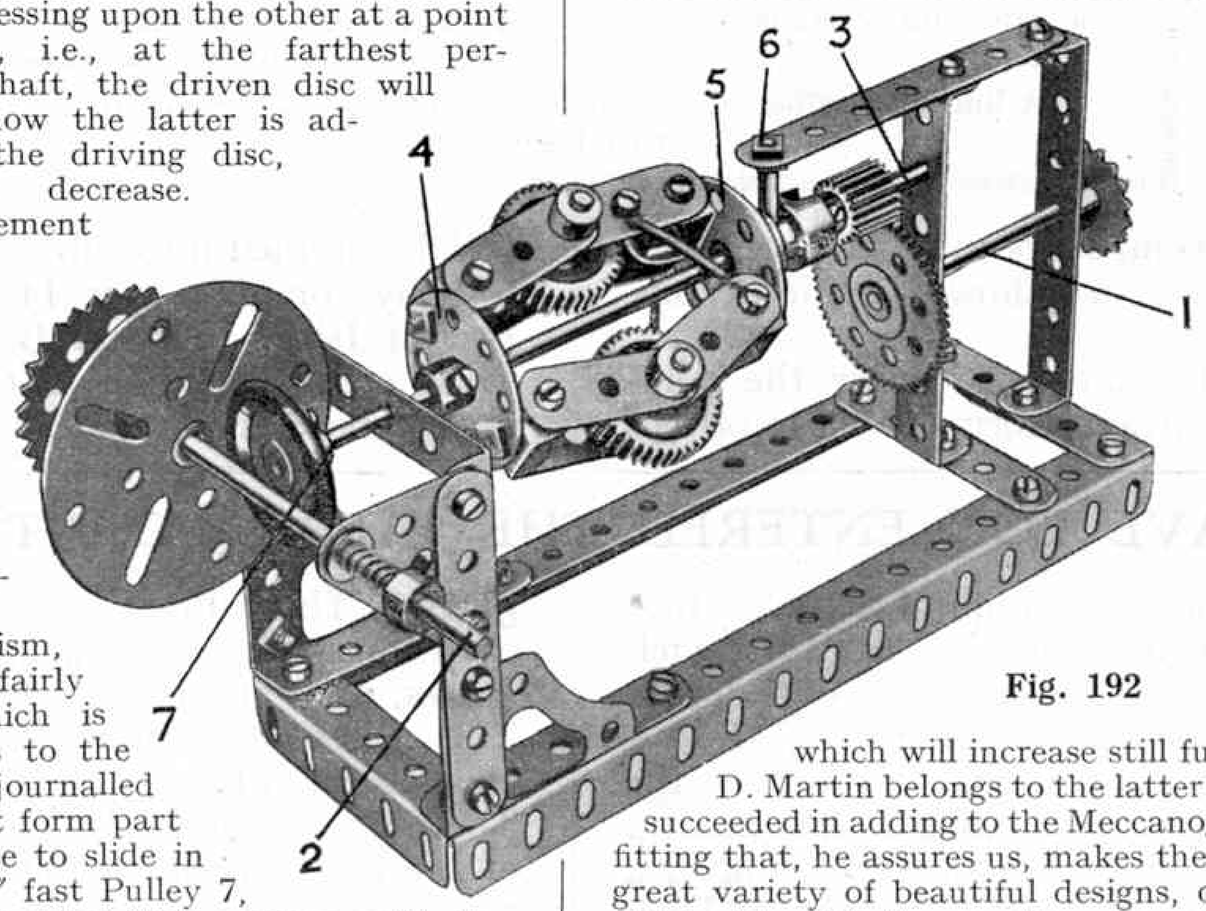


Fig. 192

(193)—Improving the Meccanograph

(D. Martin, Peterborough)

If votes were taken amongst "*M.M.*" readers as to the most popular model in the Meccano series, we feel sure that the Meccanograph (Special Instruction Leaflet No. 13) would very nearly, if not quite, head the list. The reason for the popularity of this remarkable model lies, of course, in its ability to produce hundreds of intricate and beautiful designs merely on operation of a handle. In addition, it has a special appeal for the Meccano boy with an artistic temperament, for he may make the designs still more beautiful by the judicious use of coloured inks and water-colour paints. On the other hand, the mechanically-minded boy finds unlimited scope in the model for the use of various "gadgets" that he can construct and which will increase still further the range of designs.

D. Martin belongs to the latter category, evidently, for he has succeeded in adding to the Meccanograph an extremely interesting fitting that, he assures us, makes the model capable of producing a great variety of beautiful designs, over and above those already obtainable with the machine.

Instead of being attached pivotally by a Rod to the sliding carriage, the writing arm, to which the pencil is fastened, is mounted on a Threaded Pin that is secured to a Face Plate. The Face Plate is mounted on a Rod journalled in suitable bearings in the sliding carriage, and carries at its lower extremity a ½" Pinion, which is in mesh with a fixed Rack Strip. Hence it will be obvious, that, on motion being imparted to the sliding carriage, the Face Plate, together with the writing arm, is given a rotary motion and by this means a new series of designs is produced.

A point that may escape the attention of some Meccano boys is the importance of eliminating "play" or "back lash" in the moving parts of the Meccanograph. Particularly is this the case with the Designing Table, but here the undesirable effect may be eliminated by securing a large Pulley to the vertical Rod that carries the Table, and controlling the Pulley by a screw-operated band brake similar to Standard Mechanism No. 105.

(194)—A Mysterious Printing Machine

Prizes for Solutions

There is no doubt that conjuring tricks exercise an extraordinary fascination over boys and few "*M.M.*" readers can have witnessed some of the seemingly impossible "stunts" performed by professional illusionists without feeling the desire to imitate their efforts. The amateur conjurer who attempts the time-honoured trick of producing a rabbit from a hat or something equally hackneyed and who so often fails dismally, cuts a sorry figure. But if he performs a trick successfully, he is regarded almost as a hero—at least, by the younger members of the audience!

The device shown in Fig. 194 was suggested, by a coincidence, almost simultaneously by two Meccano boys, A. Lonnon (London, W.8) and B. Rowe (Ilford, Essex). Its operation is truly amazing at first glance. On placing a clean piece of paper between the rollers and turning one of the hand wheels the paper emerges on the other side complete with a printed reproduction of a Meccano model! Or a Bank of England note may be inserted and promptly transformed into a piece of blank paper (a result likely to produce much consternation on the part of the person who loans the note!) The operation of the model is so mystifying and yet so simple that, before describing its construction we have decided to set "*M.M.*" readers a test so as to discover how many can solve the mystery for themselves. A prize of half a guinea will be presented to the sender of the first correct solution received and, in addition, six consolation prizes, each consisting of a copy of the Meccano Engineer's Pocket Book, will be awarded.

To enter this novel competition all that you have to do is to write down briefly and clearly how you think the results just described are obtained. If you think a sketch will help you to explain, you may send one along. Actual models must not be submitted.

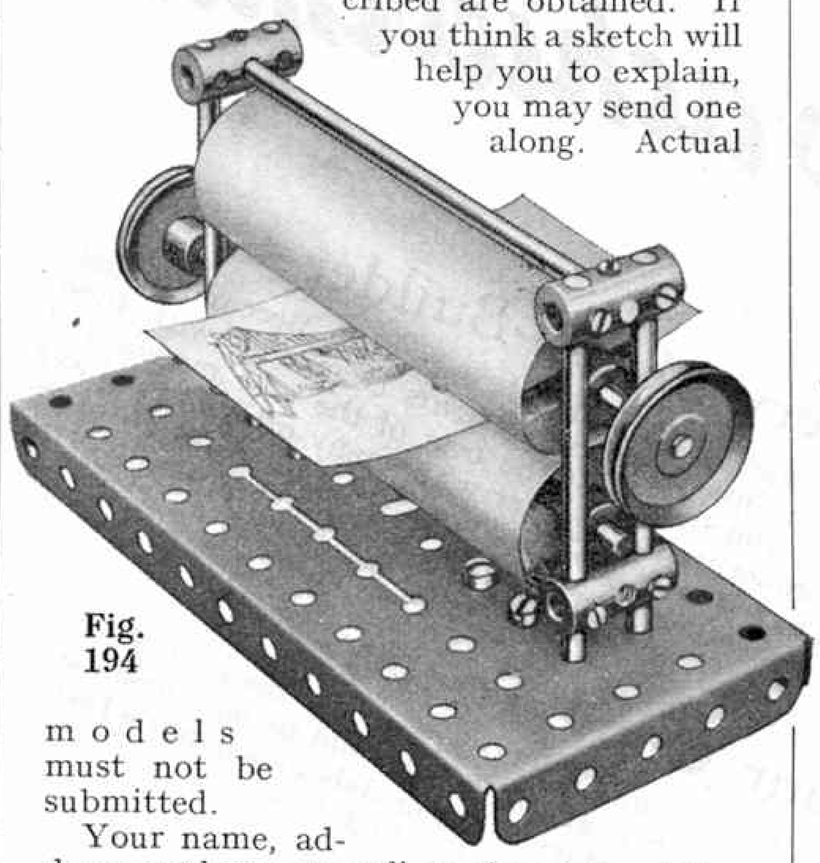


Fig. 194

Your name, address, and age as well as the name of the competition ("Mystery Model") must appear on the back of each sheet of paper used, and envelopes must be addressed "Mystery Model" Competition, Meccano Ltd., Old Swan, Liverpool. Entries must be received not later than 31st May.

(195)—Apparatus for Drawing Ellipses

(E. Armitage, Garston, Liverpool)

To draw a circle or a straight line is, as every "*M.M.*" reader knows, an easy matter, for in the one case compasses may be used, and in the other ruler, pencil, set-square and T-square may be employed. But when elliptical figures are to be traced, a certain amount of difficulty presents itself on account of the fact that none of the usual drawing instruments are of any practical use. With the apparatus shown in Fig. 195, however, figures of this nature may be drawn with a remarkable degree of accuracy.

Two Flat Plates 1 are bolted together face to face with 2½" Strips separating them so that they are free to slide upon the flanges of 9½" Angle Girders that are attached to vertical 2½" Flat Plates on the base frame of the apparatus. The Plates 1 have secured to them a Double Bent Strip, in which is journalled a short Rod carrying a Coupling. The latter carries a Rod 3, which is fitted with a second Coupling to which a third Coupling is attached by means of a 1" Rod. This 1" Rod is passed through a strip 2 before being secured in the Couplings.

The Couplings should be secured very firmly, so that the Rods 3 and 4 cannot move out of alignment with each other. The strip 2 consists of two 12½" Strips overlapped and bolted together, and sliding freely in Eye Pieces that are attached to the ends of the frame.

The Rod 4 carries at one end a Small Fork Piece, in which the pencil is clamped by a ½" Bolt passed through the jaws. To draw an ellipse a sheet of paper is pinned to the base board of the instrument and the Rods 3 and 4 adjusted to give an ellipse of the desired width and length. The pencil is then lightly held between finger and thumb and guided over its elliptical path. The instrument can, of course, be made larger if desired, but in any case it is very important that the Couplings should be secured very firmly to the Rods, and the slide 1 and the Strip 2 should work freely, but without undue play or slackness, in their respective guides.

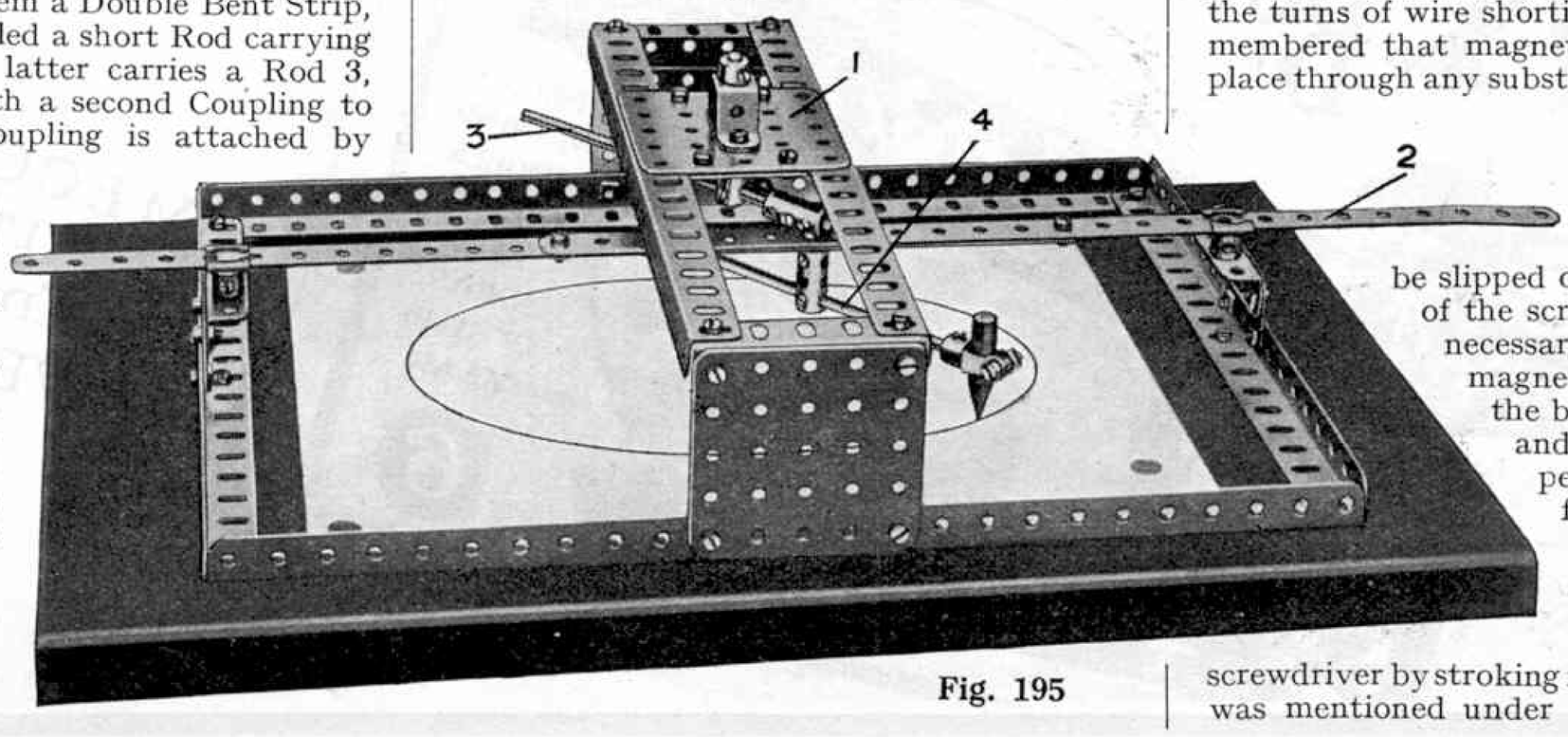


Fig. 195

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.86). A Handy Foot Pump.—An ordinary hand cycle pump may easily be converted into a useful foot pump, if the suggestion described by E. Cook (New Cheriton, Hants.) is adopted. Two Girder Frames are connected together, face to face, by three Double Brackets, and the threaded portion of the pump connector is passed through the hole of the Double Bracket joining the apices of the Girder Frames, before being screwed home into the body of the pump. The feet may be placed on either side of the device and the task of blowing up cycle tyres accomplished with ease.

(M.87). Improvement to Chassis Clutch.—Some of our readers assert that the Rubber Ring forming part of the clutch of the Meccano Motor Chassis (Leaflet No. 1) is likely to come off the 1" fast Pulley on which it is mounted. Whilst we have experienced no difficulty in this direction, it may be of interest to describe the way in which E. Whitmore (Tunbridge Wells) remedied the alleged fault. The 1" fast Pulley carrying the Rubber Ring is backed by a 1⅛" Flanged Wheel, so that no matter how hard the sliding portion of the clutch pushes against the Rubber Ring the latter cannot slip off its Pulley.

(M.88). Addition to the Theodolite.—E. Stradling (Usk, Mon.) puts forward an idea for the improvement of the Theodolite (Model No. 5.8 in the Manual of Instructions). The sighting arm, instead of consisting of one Rod, could, he points out, be composed of two Rods joined together with a short Strip, the connection between the Strip and the Rods being formed by End Bearings or Strip Couplings. If the Strip were arranged opposite the scale, the divisions on the latter could be read off with much greater accuracy than formerly.

(M.89). Magnetic Screwdriver.—In the building of intricate models it is often necessary to insert bolts in almost inaccessible positions. In such cases T. Hatch's (Three Rivers, Canada) suggestion for a magnetic screwdriver should prove welcome. To form the tool he wound some fine cotton-covered wire on a bobbin made from tinfoil, and placed the bobbin on the shaft of an ordinary screwdriver. The tinfoil is unnecessary, however, for the bobbin could be made much better from cardboard ends and a paper core, as this would prevent the turns of wire shorting (it should be remembered that magnetic effects can take place through any substance), or it would be better still to use the Meccano Bobbin (part No. 301), which has the advantage that it can be slipped on and off the blade of the screwdriver. It is not necessary always to keep the magnetising current on, for the blade is of hard steel and the magnetic properties will be retained for a considerable time. R. Chappel sent in a similar idea. The magnetisation of a screwdriver by stroking it with a bar magnet was mentioned under Suggestion No. 69.

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There is a special edition for Overseas, price 9d. from dealers or 10d. post free. 15 cents from dealers, or 20 cents post free, from the agents (Canadian prices—

Readers in Australia, New Zealand, South Africa or Canada who require copies should apply to their dealers or should address their orders to our agencies as detailed below. Readers living in countries other than those mentioned should order from Meccano Ltd., Old Swan, Liverpool, sending a remittance of 10d. with their order.

Australia : E. G. Page & Co., 52, Clarence Street, Sydney (P.O. Box 1832).
New Zealand : Models Ltd., Kingston Street, Auckland (P.O. Box 129).
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South Africa : Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

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MECCANO
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In this page, month by month, we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of these suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on a separate sheet of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

BUCKET TEETH.—We were interested in your suggestion that we should introduce special "teeth" or "tines" for fitting to the cutting edge of a built-up excavator bucket. These teeth would somewhat resemble a standard Flat Bracket with the exception that only one circular hole would be punched in them and one end would be brought to a sharp point instead of being rounded. By means of their perforations it would be possible to bolt a number of these teeth to a Flat Plate or other part forming the bottom of the built-up bucket, thus greatly increasing its digging or cutting powers. We shall certainly give this idea close attention. (*Reply to D. Redman, Calgary Canada*).

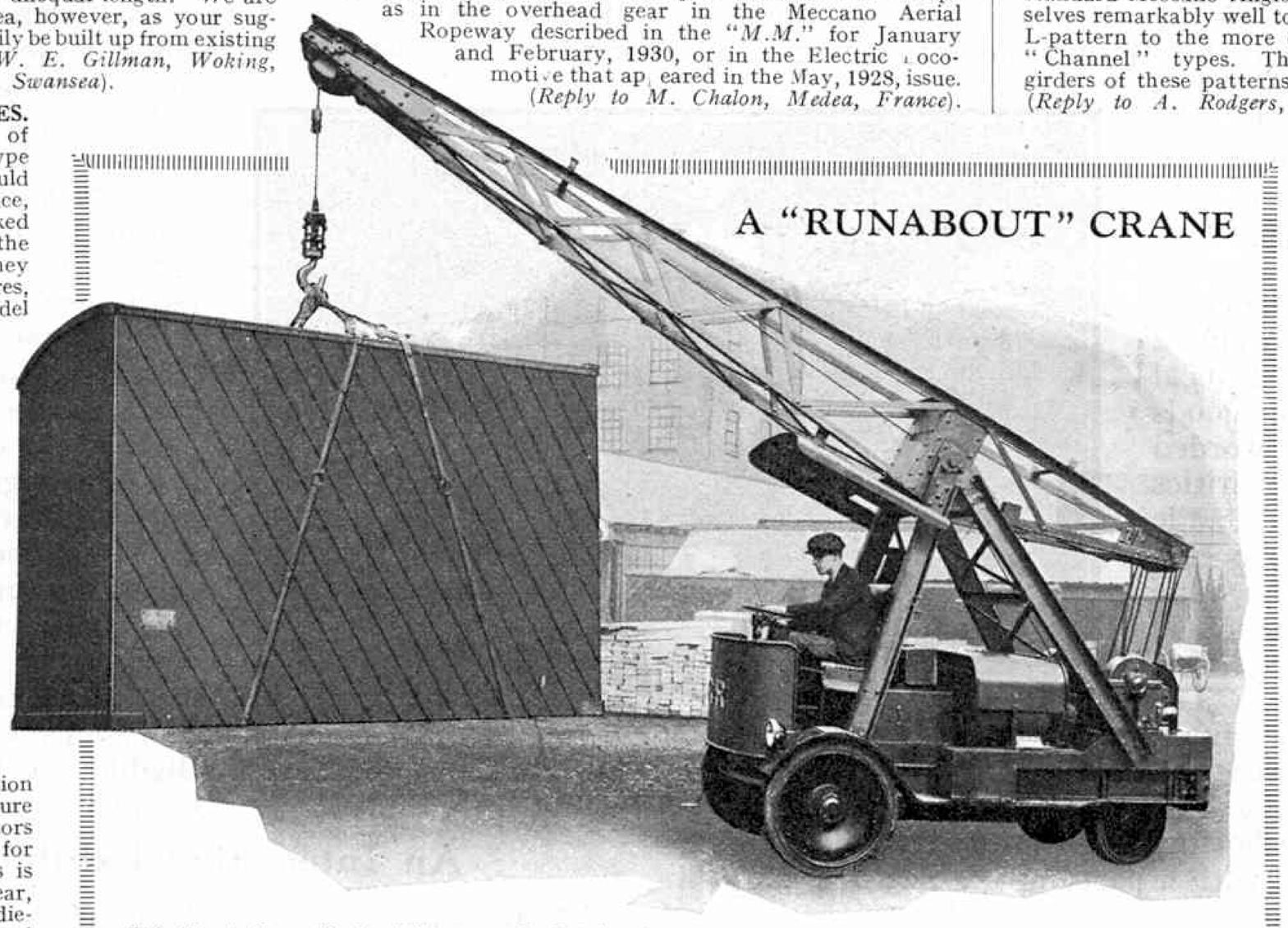
NEW ANGLE STRIP.—We note that you advocate the introduction of a range of Double Angle Strips having angle portions of unequal length. We are not in favour of the idea, however, as your suggested parts can quite easily be built up from existing accessories. (*Reply to W. E. Gillman, Woking, Surrey, and S. Redman, Swansea*).

"BALLOON" TYRES.—We are not thinking of introducing "balloon" type motor tyres as these would be expensive to produce, and would possess a marked tendency to "roll off" the Pulleys to which they were fitted. Balloon tyres, when fitted to a model motor car, might enhance its appearance slightly, but we would point out that the existing Dunlop Tyre is of quite liberal dimensions when "scaled" with other fittings, and while it is not actually of the balloon variety, it is certainly an "oversize." The existing range of Tyres can moreover be employed in various forms of friction gearing. (*Reply to W. E. Avory, London, W.11*).

MOTOR RADIATORS.—Your suggestion that we should manufacture various types of radiators cast from lead alloy for use on Meccano models is interesting, but we fear, hardly feasible. The "die-casting" process is used for a number of the Hornby parts and fittings such as lamps, wheel and finnials and even the "cab interiors" of the Hornby Special Locomotives, but it would not be advisable to apply the process to the manufacture of a model radiator owing to the high cost of the metal needed and consequent weight. Furthermore, special radiators are really unnecessary additions as it is quite a simple matter to improvise them from Sector and Flanged Plates, Strips and other parts. The "dummy" radiator fitted to the Meccano Motor Chassis for instance, is quite a good example of this type of construction. (*Reply to J. Walker, Roby, Liverpool*).

SERRATED BOSS.—Your suggested accessory resembling a Threaded Boss but having a number of radial serrations cut on its ends, would not, we consider, be of much use in the Meccano system. We agree that the part might be employed as a "locking ring" in certain types of screw adjustment mechanisms, where the serrations on one of its faces would be brought into engagement with the serrated face of a similar part, but these instances would be very rare, and we conclude that the part would be of little practical value to the Meccano system. (*Reply to F. Ross, Tipton*).

CABLE SADDLE.—We were interested in your suggested part, which would be used for gripping the wire cable in a model aerial ropeway system. The saddle would be made in two forms, one for use when the cable is merely passed round the saddle but not rigidly secured to it, and the other when the cable has to be clamped securely. Although one or two uses could no doubt be found for this part, we do not think it would form a really helpful unit, and we suggest you improvise a cable saddle from standard parts when required. For instance when the cable is to be merely passed round the saddle, a Pulley Wheel could be employed and a little metal foil bound round the wire at the point of contact. Where the wire has to be securely anchored it can be clamped between two Strips as in the overhead gear in the Meccano Aerial Ropeway described in the "*M.M.*" for January and February, 1930, or in the Electric Locomotive that appeared in the May, 1928, issue. (*Reply to M. Chalon, Medea, France*).



This illustration affords striking proof of the use that modern manufacturers are making of mechanical appliances in helping to solve the problem of speedy transportation of goods. The "R and R" petrol-electric mobile Crane that it depicts will be of particular interest, since it forms the prototype of the Meccano Super Model described on another page of this issue.

NEW ENAMELLING SCHEME.—Your scheme for a new method of enamelling the coloured parts is ingenious. Your idea would be to coat one side of any given part with red enamel while the other side would have a coat of green enamel applied to it. In practice the parts would be turned with either the red or green enamel surface facing the exterior and a perfectly uniform colour would be given to a large model in place of the red and green colouring that results with the existing method. We would point out to you, however, that this scheme would not work out correctly in practice, as only such parts as Strips, Flat Plates, Flat Trunnions, etc., are "reversible accessories," i.e. they can be turned on either side without altering their functions, and the two colour effect would still have to be used. Rather than objecting to the combination of the red and green enamel, however, most model-builders find it gives a distinctly ornamental and pleasing touch to their models. Your suggestions regarding a new Fork Piece and Coupling Hook are receiving attention. (*Reply to J. Stouff, Troyes, Aube, France*).

ALTERATION TO FLANGED PLATE.—We are not in favour of your idea that alternate rows of holes in the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate should be elongated. By far the most important use of this part, especially in the smaller models, is as a base plate, and if superstructures were secured to the Plate by bolts placed in elongated holes or slots, the rigidity of the complete model would suffer. (*Reply to C. Brown, Barwick, Leeds, and R. C. Houston, Brighton*).

H-GIRDER.—It would be very costly to produce lengths of H-section perforated girder as it would be necessary to "draw" or roll the girder from the solid metal. One of most interesting and instructive experiments in Meccano, is to build up the various types of girder sections used in structural engineering; the standard Meccano Angle and Flat Girders lend themselves remarkably well to the elaboration of the simple L-pattern to the more complicated T, H, and U or "Channel" types. The separate manufacture of girders of these patterns is consequently unnecessary. (*Reply to A. Rodgers, Glasgow*).

MILLED RODS.—It would not be advisable to mill or machine the surfaces of the Meccano Rods as you suggest, as this would in the first place be a costly procedure and would raise the price of the parts, and secondly it would not allow axles to rotate freely and smoothly in their journals as the milled surface would grind away the bearing and create excessive friction. You should have little trouble in securely locking Gears, etc., to shafts by means of the set-screws, but in cases where a great strain is imposed on the parts (as in the picking motion of the Meccano Loom), it may be advisable to file small flats on the rods where the set-screws are secured. (*Reply to A. W. L. Cobbe, Cobham, Surrey*).

SPIRAL SCREW.—We note your suggestion regarding the introduction of spiral screw conveyor to the Meccano system. The type of screw which you suggest is known as an "Archimedian Screw" and in shape somewhat resembles a wood-screw with "threads" formed from heavy gauge metal sheet attached in the form of a spiral around a centre rod. The screw, which is of course made to large dimensions, is employed in certain cases for lifting water and also granulated substances in confined spaces. A screw of the type is certainly an interesting mechanism but we do not consider it would have any practical application in Meccano. You could, however, build a model of this screw using Meccano in conjunction with either tin plate or thick cardboard. (*Reply to R. Lancon, Marseilles, B. du. R*).

HEATER ELEMENT.—Your scheme for an electric heater element that would be fitted around the boiler of the Meccano Steam Engine is distinctly ingenious. By connecting the resistance coil forming the heater to a standard electric light plug, steam could be raised in the boiler by the simple process of placing the plug in a light socket! The great drawback to the idea is of course the cost and if the suggested heater were fitted the price of the complete steam engine would have to be increased considerably. However, an "electrified engine" might appeal to those willing to pay the extra cost and we are making a note of your scheme. (*Reply to A. Thurber, Alberta, Canada*).

The Summer Programme

The thoughts of members of Branches are now turning to outdoor activities and due allowance should be made for this in planning the programme for the coming months. For instance, now is the best time to arrange interesting visits to engine sheds, goods yards and other places of railway interest, and I hope that during the coming summer the members of every Branch will have many such opportunities of seeing how things are done on real railways. If they are fortunate in this respect work on the Branch layout during the following winter sessions will be far more like the real thing, not only in planning, but also in the manner in which operations are carried out.

As a rule little difficulty is experienced in obtaining permission to visit a local station engine shed or goods yard. A politely-worded application to the authorities concerned should be made well in advance of the suggested date, and the time and the number of members likely to make the visit should be stated. The number given in the application should not be exceeded, for this might prove disconcerting to the authorities, who no doubt will make arrangements to deal with a party of the size originally advised.

Members of the Hendon Branch, No. 19 ; Chairman, Mr. A. L. Owen, Secretary, A. Needell. This Branch is conducted in conjunction with the Hendon Meccano Club.

Branch Photographs

On visits of this kind I hope that cameras will not be forgotten, but these should not be used until it has been made quite clear that photography is permitted. A pictorial record of such a visit is always of very great interest. As examples published in these pages in past issues of the "*M.M.*" have shown, a group of members in the cab of a locomotive, or closely examining some feature of special interest, is far more exciting than a formal group photograph. I hope to receive many photographs of this kind and look forward to efforts showing even greater originality than those already published. As far as space allows, those that are suitable will be published on the H.R.C. pages of the Magazine, and to every Branch so distinguished will be awarded a prize of 5/–.

In deciding whether a photograph is worthy of inclusion its technical merit will not be taken into consideration provided a satisfactory reproduction may be made. The chief requirement is interest from the point of view of the H.R.C. In most Branches at least one member possesses a camera and will be quite willing to use it for this purpose. Any out of pocket expenses may be recovered by charging a few pence for prints of successful photographs, or they may be met from Branch funds.

Branch photography need not be confined to visits of this kind. One or two excursions also should be made to the seaside or to inland pleasure resorts, for such outings afford very welcome variety in the programme. In many instances also track work during the coming months will be carried out in the open air. I recommend this course very strongly, for the construction of an outdoor layout gives great scope for ingenuity on the part of the members. Good photographs of outdoor railways, particularly if they show members actively engaged in running or shunting operations, will be greatly appreciated and, together with those taken on Branch excursions of all kinds, are eligible for the award that I have already mentioned.

An Interesting Exhibition

An Exhibition that had many points of interest recently was held by the First Rhyl Branch. This was organised in conjunction with the Rhyl Meccano Club, an admirable plan that enabled both organisations to make a much more satisfactory show than if separate functions had been held.

Many interesting Meccano models constructed by members were displayed, but to most visitors the chief centre of attraction was the Branch layout. This was constructed throughout of double track, and on it were a station and several loop lines. A very extensive service of trains of all kinds was run and visitors were greatly astonished to see how readily the locomotives employed hauled the heavy trains.

I have been informed that members enjoyed the proceedings quite as much as their visitors. I am always very pleased to learn details of this kind in regard to any Branch, for it shows that the members are getting the greatest possible amount of fun from their hobby.

Branch Notes

SLIGO.—The Branch layout has been designed to allow two or three trains to run simultaneously. These are timed at stations and worked according to a pre-arranged plan. Experiments are being made with an engine fitted with toothed wheels to run on rack rails, as on mountain railways. Locomotives are kept strictly to the work for which they were designed, one intended for goods work not being used to haul passenger trains. Secretary: K. McMenamin, 78, John Street, Sligo, Ireland.

HAROLDWOOD.—A monthly meeting is held to discuss business affairs and to arrange the programmes for the coming meetings. One afternoon has been set aside for the testing of Branch locomotives, which number 15. A lending library has been started and is proving very popular. Secretary: C. L. Barber, "Beaurains," Church Road, Haroldwood, Essex.

ST. CHADS (WITHINGTON).—Careful attention has been paid to the signalling of the Branch railway track. Two large signal gantries are being constructed, in addition to a Meccano 20-lever frame for signal and point control. One meeting was devoted to the cleaning and oiling of all stock and afterwards a special train was made up to inspect the track. An interesting accident was staged and after the line had been systematically cleared the officials in charge of the breakdown train made full reports on the mishap. Secretary: R. W. T. Mackley, 34, St. Chads Road, Withington, Manchester.

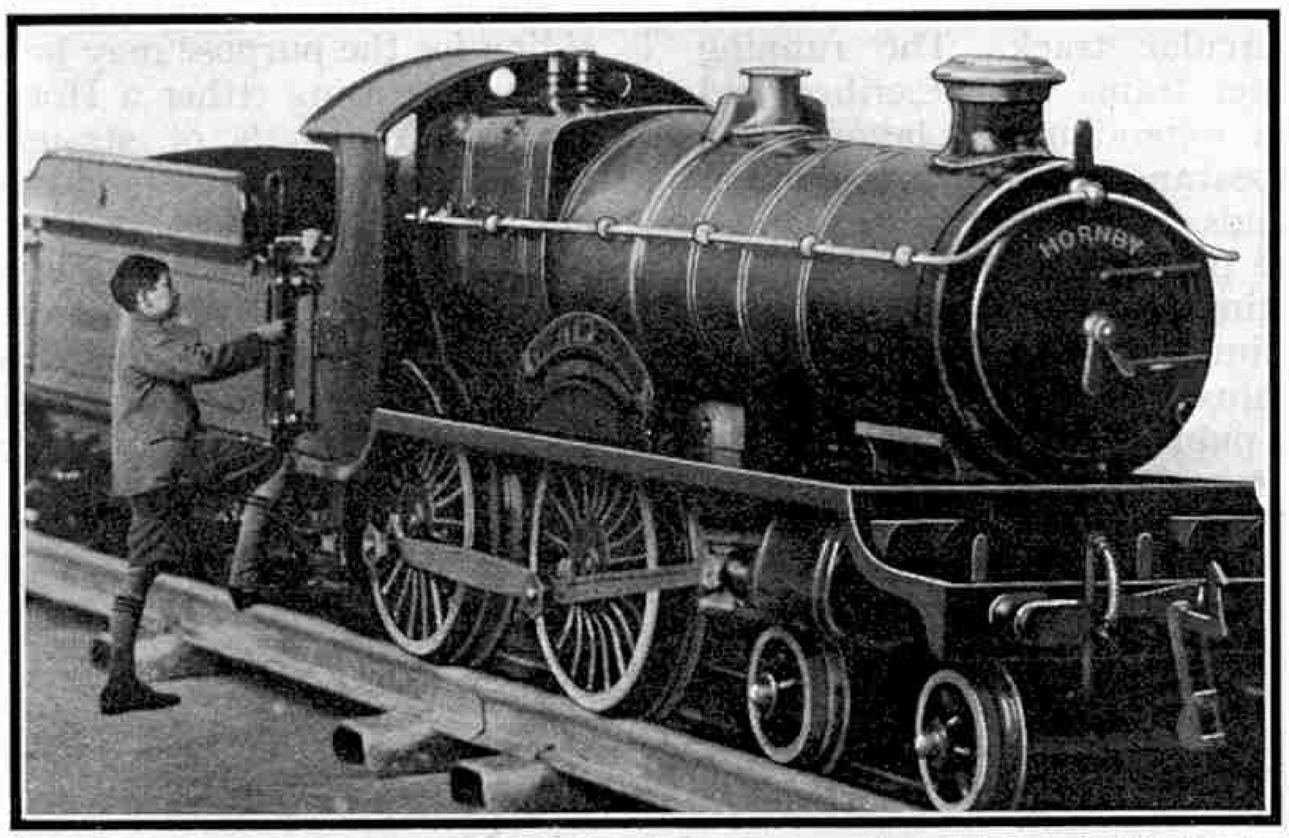
THE OXTON (BIRKENHEAD).—A very interesting visit was paid to the Meccano and Hornby Train Factory, Liverpool. The Branch has been divided into two sections, "Carpenters" and "Electricians," each section being responsible for the upkeep of part of the Branch track. The "Electricians" are designing a colour light signalling system. A Debating Section has been started. The first Debate was on "*Railways v. Airways*," and the general superiority of railways as a means of transport was carried by vote. Secretary: J. H. McGuinness, 63, Beresford Road, Birkenhead.

THE HALL (SYDENHAM).—The Branch layout has been extended and new rolling stock purchased out of Branch funds. A haulage test was won by a No. 2 Special Locomotive. An engine shed has been made and fitted up with electric light. An interesting visit was paid to the Model Railway Club Exhibition. Secretary: J. D. Davies, 28, Kingsthorpe Road, Sydenham, London, S.E.26.

ELLESMERE (DULWICH).—A very enjoyable cinematograph evening was held. Films dealing with paper-making, telephotography, electro-plating, and the use of parachutes were shown, and in addition one or two comic pieces. The layout of "Liverpool Street Station" on the Branch railway has been re-designed and operations speeded up considerably. Members have visited King's Cross Locomotive Sheds. Secretary: N. R. Rice, 32, Elsie Road, London, S.E.22.

LYTHAM CENTRAL.—The track has been completed and the club room is now being decorated. It is proposed shortly to pay a visit to the Blackpool engine sheds. In a recent Mock Trial the prisoner was charged with switching off the lights in the chief station on the line and thereby causing unnecessary confusion. He proved rather violent and three "policemen" were required to keep him in order. A very severe sentence was passed on him! Secretary: Frank Lucas, 2, Church Road, Lytham, Lancs.

EXHALL.—The Branch track has been re-designed. It is now of the horse-shoe type, with two termini and two through stations. Hornby double track is used throughout and three-colour light signals are controlled from a central point. On Visitors' Evening timetable working was demonstrated and various shunting operations explained. A large combined Hornby Train and Meccano Exhibition was extremely successful. Secretary: Malcolm Melville, Exhall Vicarage, Nr. Coventry.



A wonderful dream! A member of the Hornby Railway Company climbs into the cab of his Hornby No. 2 Special Locomotive, "County of Bedford." For this clever composite photograph we are indebted to A. L. Parminter, Minehead (H.R.C. No. 15981).

AUSTRALIA

GEELONG (VICTORIA).—A very interesting visit has been paid to the South Geelong Goods Yard. Shunting operations were witnessed and several photographs were taken. A club room has now been secured and an extensive permanent track is being constructed. This is correctly signalled, and points, brake rails, etc., controlled from the signal cabins. Experiments also are being made with automatic signals. Secretary: C. Aldridge, 65, Gilgour Street, Geelong, Victoria.

WESTRALIAN.—This Branch has adopted the Great Western system with stations at Paddington, Swindon and Cardiff. About 100 ft. of track is laid and an average of 10 locomotives are operated at each meeting. One Pullman train has been fitted throughout with electric light. A Meccano engineering section has been established for the construction of bridges, turntables, etc. Interesting loco tests have been carried out with some surprising results. A recruiting campaign has been started and the Chairman hopes to recruit boys living in the Bush and Wheat Belt districts. Boating is a favourite pastime with Branch members and frequent picnics are also held. Secretary: S. H. Chittenden, 576, William Street, Mt. Lawley, Perth, Western Australia.

Further Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BIRMINGHAM—E. Sharp, 156, All Saints Road, King's Heath, Birmingham.
BUDE—G. D. Hews, St. Petroc's, Bude, N. Cornwall.
DORSET—M. Steele, 16, Florence Road, Parkstone, Dorset.
EDINBURGH—H. Govan, 35, Comely Bank, Edinburgh.
GLOUCESTER—D. C. Yates, "Brunton," Brockworth, Gloucester.
HARROW—J. S. Dodson, 2, Greenhill Cres., Harrow.
HOVE—R. Pullen, 27, Kendal Road, Hove.
PRESTATYN—R. Evans, "Mohrcroft," Princess Avenue, Prestatyn, N. Wales.
ROCK FERRY—W. J. Davies, 17, Beech Road, Woodhey, Rock Ferry.
SPALDING—Eric Lambert, 12, South Parade, Spalding, Lincs.
ST. ANDREWS—R. L. C. Lorimer, 19, Murray Park, St. Andrews, Fife.
BROMBOROUGH—J. Townsend, 11, Neville Road, Bromborough, Cheshire.
LIVERPOOL—L. Blundell, 31, Bedford Place, Seaforth, Liverpool.
EPSOM—J. F. Long, "Shirley," Kingsdown Road.
TAMWORTH—R. Harries, Alvecote Grange, Nr. Tamworth.
TRURO—Norman Dash, 15, Carelew Terrace, Truro, Cornwall.
WALTHAMSTOW—K. G. Eastaway, 277, Wood Street, Whipp's Cross, Walthamstow.
WEALDSTONE—J. E. Skoyles, 30, Aberdeen Road, Wealdstone, Middx.

OVERSEAS

AUSTRALIA—L. Creed, 38, James Street, Glenhuntley, S.E.9., Victoria.
NEW ZEALAND—A. G. Saunders, 17, Te Aroha Street, Hamilton, New Zealand.

Further H.R.C. Incorporated Branches

111. SPALDING (ROKEBY)—Mrs. P. Robinson, 49, Pinchbeck Road, Spalding, Lincs.
112. WINCHESTER RAILWAY AND TRANSPORT BRANCH—E. A. W. Chalkley, 78, Hatherley Road, Winchester, Hants.
113. ST. JOHN'S SCHOOL (LEATHERHEAD)—H. C. Carpenter, St. John's School, Leatherhead.
114. WEST KENT—F. R. Dubery, 48, Reddons Road, Beckenham, Kent.
115. ROSE HILL SCHOOL (TONBRIDGE)—H. F. Hills, "Collingwood," The Drive, Tonbridge, Kent.

Hornby Railway Company

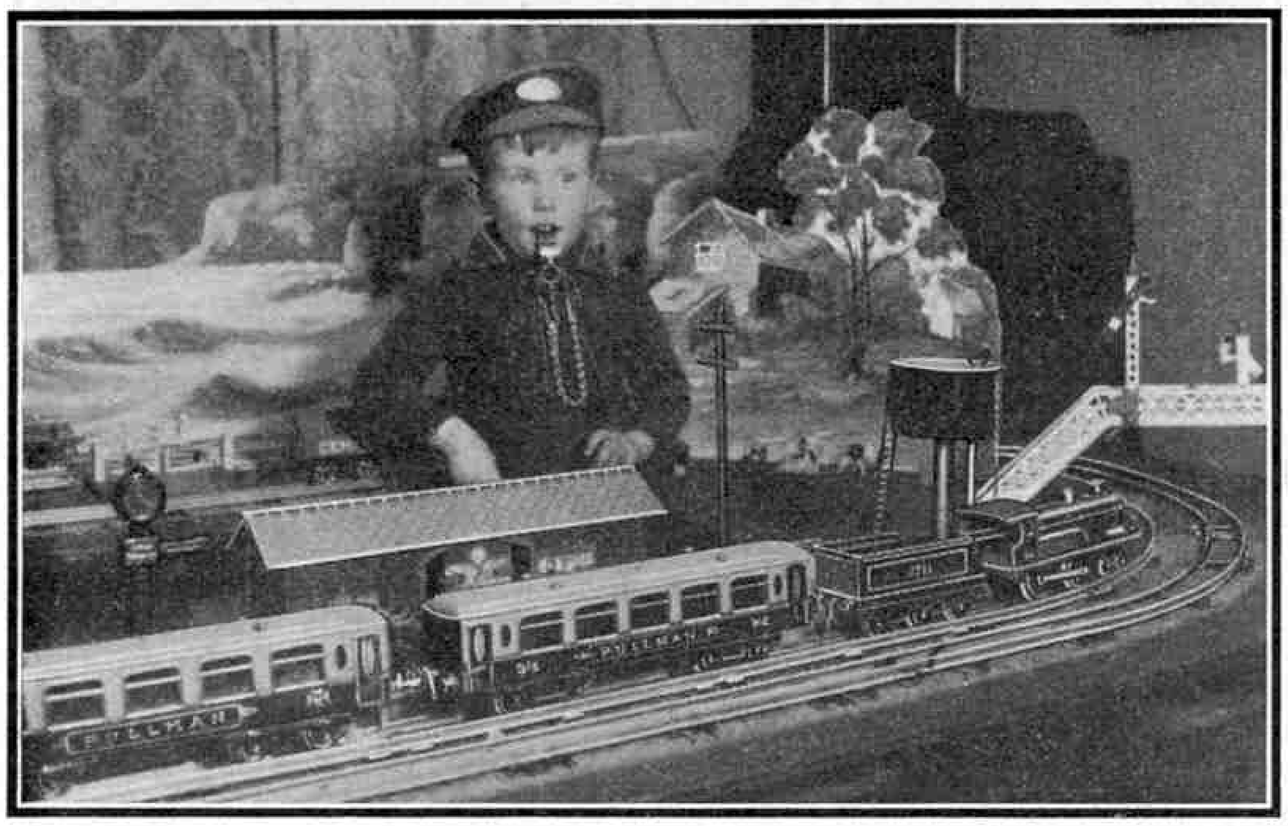
JUNIOR SECTION

XVII.—Shunting on a Simple Layout

LAST month we dealt with simple track work on a miniature railway consisting of an oval layout combined with a circular track. The running of both goods and passenger trains was described and suggestions were made for extending the layout, and also for improving its appearance by the introduction of accessories of various kinds. This month we propose to turn our attention more particularly to goods traffic and to show how interesting track work of this kind may be carried out on a simple layout.

The running of goods trains does not attract so much attention from the general public as the work of famous expresses, but every H.R.C. member is well aware that it is a very important feature of real railway work.

Quite as much fun may be obtained from the working of goods traffic as from running passenger trains, attractive as the career of a handsome Pullman train run on a well-appointed track may be. One reason for this is the wonderful variety of wagons that may be employed. In addition to Hornby Wagons and Luggage Vans of the ordinary type, these include Cattle Trucks, Biscuit Vans, Tank Wagons, Refrigerator Vans and other vehicles designed for special purposes. All of these may form part of a goods train, and to add to the interest, they are not merely run together over the layout, halting for a few moments at each station, but they are picked up, shunted into sidings and marshalled into new trains in readiness for their final stages of their journeys.



G. M. Sturgeon (H.R.C. No. 1275) ready to give the signal for the departure of a Hornby express train from a station on his extensive layout. This is supported on trestles and occupies a space 15 ft. in length and 6 ft. in width.

On quite a small layout really interesting shunting operations may be performed and, in fact, they are necessary if goods traffic is to be handled as it is on real railways. The simplest example of a goods train is the "pick-up." This stops at intermediate stations in order to take up or put off wagons and according to the usual code is distinguished by carrying one head lamp over the left hand buffer. There is no difficulty in reproducing its operations on a miniature Hornby Train Layout, and many Junior enthusiasts who have watched it at work in the goods yards of their local stations no doubt desire to do so.

The layout required for the simple shunting carried out by the "pick-up" need not be elaborate, and in fact a single siding or loop road is sufficient. An excellent siding for the purpose may be added to an ordinary oval layout by using either a Hornby crossover or a pair of points. A length of straight rail serves as siding, of course, and this should be laid down parallel to one of the long sides of the layout. The connection to the main line should leave the siding about the middle, for this gives us two tracks on which wagons may be shunted, one being situated on each side of the points or crossover. This is a great advantage, since trains on the main line may approach the siding in each direction, and the shunting is carried out by the locomotive that hauls the "pick-up."

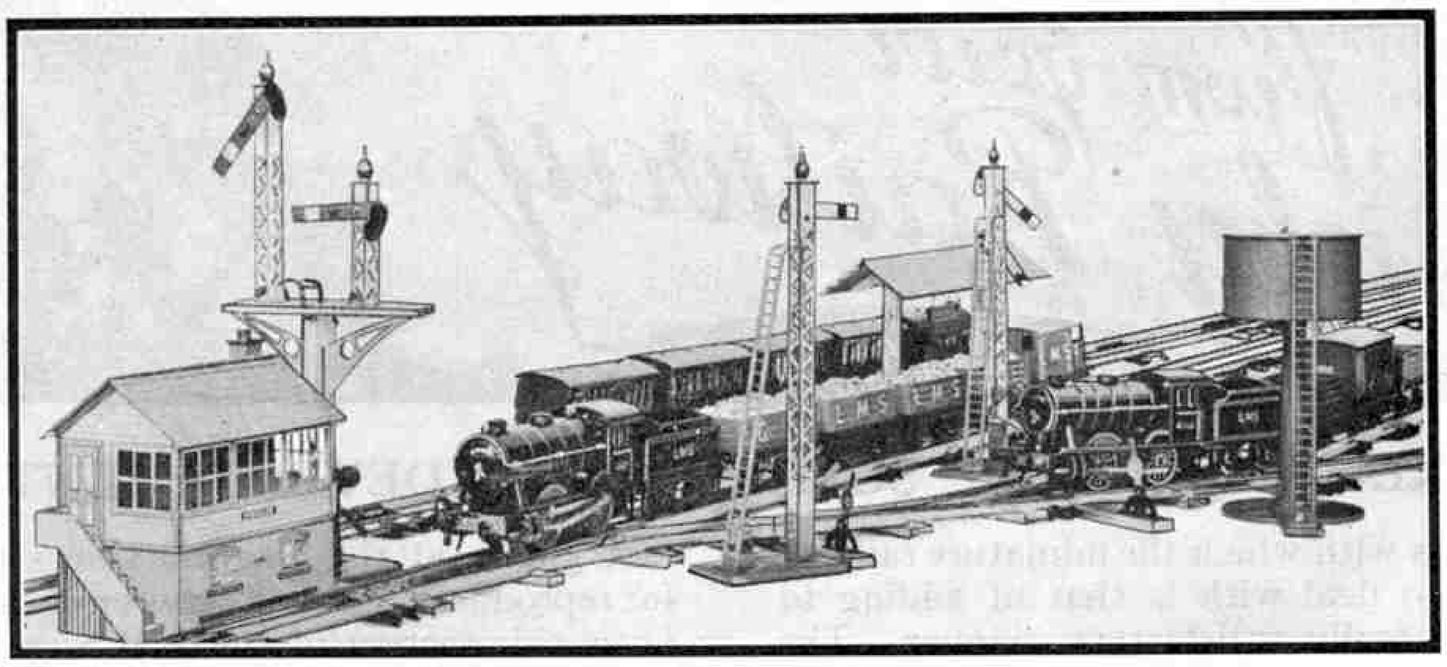
Let us suppose that we have constructed a siding in this manner and that the "pick-up" has arrived. This brings with it wagons to be left at our station and at one end of the siding stand others, already loaded, that are to be taken away. If this is the first call made by the "pick-up" the wagons that are to be left will be next the engine. The rest of the train is therefore cut off and left standing on the main line. With the wagons destined for our station the locomotive runs into the siding and backs on to those that are to go forward. These are coupled up and backed down on to the rest of the train. The locomotive returns to the siding, this time bringing with it the wagons to be detached. After these have been pushed to the end of the siding and detached, the engine runs on to the main line once more, is coupled on to the train and is ready for departure to the next station.

At the second call the wagons to be detached are not next the engine. This place now is occupied by the vehicles picked up at the first station, and the wagons to be left are behind them. This, of course, makes practically no difference to the operations that are carried on and these follow the lines already described.

By the time that the "pick-up" has reached the end of its journey it will have left behind it all the wagons destined for the intermediate stopping places, and in exchange will have received others for despatch

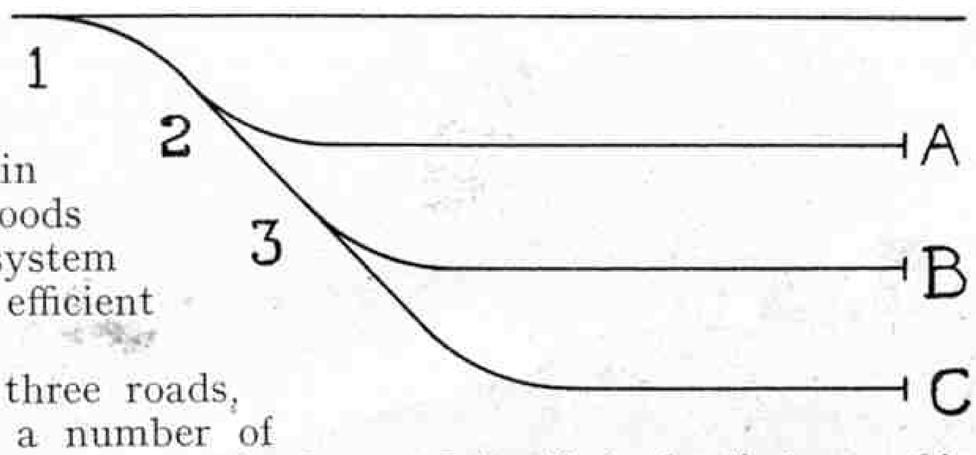
elsewhere. A complete series of operations naturally demands a number of stations, but if necessary one siding may be made to serve for each of these, the train making several journeys round the track between each call.

It will be realised that even with a simple layout the possibilities of interesting goods train working are very great, but the fun is very largely increased if a slightly extended goodsyard is laid down. The accompanying drawing shows a suitable layout. This is of a type that is used in real railway practice.



Shunting operations are suspended during the passage of a mineral train hauled by a Hornby No. 1 Special Locomotive.

By means of a right-hand point a branch is taken from the main line. Then follow two left-hand points in succession, and a curved rail is placed at the end of the second of these. The addition of straight rails to the ends of the three curves thus obtained gives a compact three-road goods yard. This is not as extensive as many found in real practice, but on it the goods traffic of a miniature railway system may be handled in a very efficient manner.



Interesting shunting on this useful goods yard layout is described in this article.

We will suppose that in the three roads, A, B, and C, of our yard are a number of wagons and that a locomotive has arrived from the engine shed in order to collect them into a train that is to act the part of a "pick-up." Following real practice, they must be marshalled in accordance with their destinations, a wagon intended for the first stopping place being next the engine, and so on, and this must be done in as few movements as possible.

In order to see exactly how the necessary operations should be planned, it is an excellent idea to number the wagons. This may be done by placing numbered slips of paper in them, and in the case of covered wagons these may be held in position in the doorways while shunting is proceeding.

As an example we may suppose that in the sidings are eight wagons and a goods brake van. Of these the wagons numbered 4, 7, and 5 are in road A, numbers 8, 1, and 3 in road B, and those numbered 2 and 6 in road C. The order of the numbers gives the positions that the wagons must occupy when the train is made up.

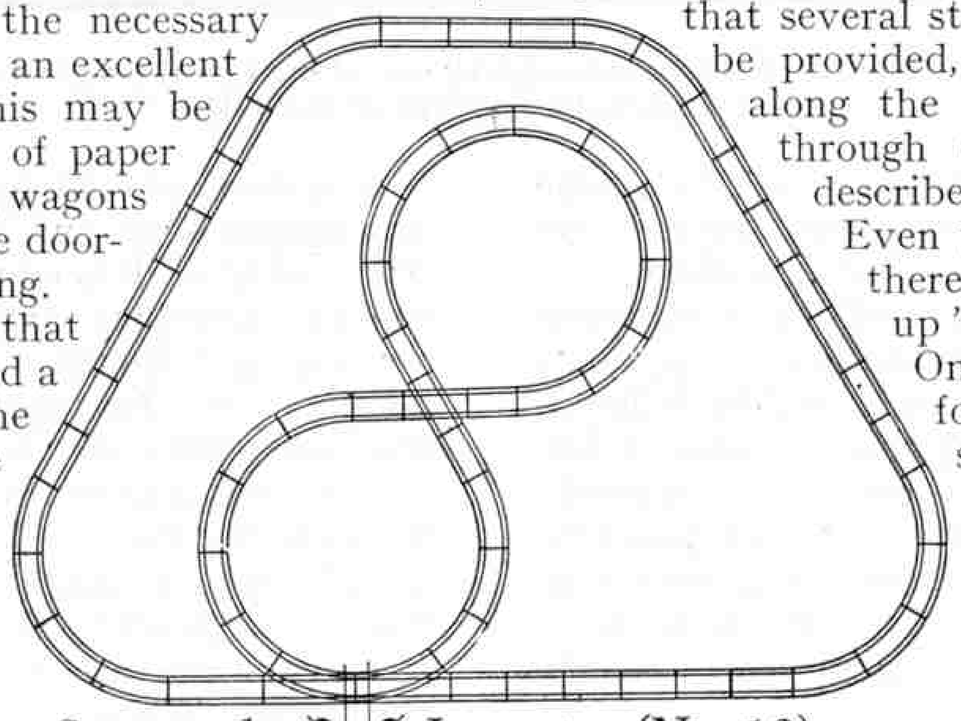
In marshalling these wagons the first move is to back the locomotive into road A, and there pick up the wagons numbered 4 and 7, these of course being properly coupled together. They are transferred to the next road, where number 7 is detached, and the locomotive with number 4 wagon then returns to road A in order to collect wagon number 5. With these two wagons behind it, the engine backs down road B and numbers 7 and 8 are attached. All four wagons are then drawn out clear of the points for road A.

We now have four of the wagons in order, with a gap between them that later will be filled by wagon number 6. These are backed into road A, and the locomotive is now in a position to collect the first three wagons in correct order. With these attached the locomotive picks up wagons 4 and 5 from road A, thus completing the front portion of the train. The rest is easy. Backing down into road C wagon number 6 is picked up and finally the wagons and brake van in road A are attached.

A pleasing variation of the use of numbers would be to mark each wagon with the name of the station to which its contents are consigned. This plan has the advantage that the reason for arranging the wagons in a given order immediately becomes apparent. It is also more railway-like in character, particularly when two or more wagons are to be set down in one station. When this is the case these wagons should be grouped together in order that they may be shunted with the same number of operations as if only one were to be left behind.

The future proceedings of our "pick-up" train depend on the size of the layout. If this is so extensive that several stations with shunting sidings may be provided, the "pick-up" simply proceeds along the line and at every stop carries through operations of the type already described.

Even if a large layout is not available there is no difficulty in running a "pick-up" train in quite a realistic manner. One station layout is quite sufficient, for it may be made to represent each stopping place in turn. It is a good idea to prepare a few cards bearing the names of stations and to use these in succession as name boards. The journey of the "pick-up" from one station to the next is made by running the train round the layout as many times as may be necessary to represent the distance that is supposed to intervene, and while the train is on its way the name card at the station may be altered in preparation for the "pick-up" operations that shortly are to be carried on in the adjacent goods yard.



Suggested Layouts (No. 10)

2′ Radius (as illustrated) : 30 Curves, 28 Straights, 1 Acute Angle Crossing, R.H. Points, L.H. Points.

1′ Radius : 14 Curves, 14 Straights, 1 Acute Angle Crossing, R.H. Points, L.H. Points.

XIX.—A LAYOUT SUITABLE FOR DEVELOPMENT

ONE of the problems with which the miniature railway enthusiast has to deal with is that of adding to his layout in a really satisfactory manner. The desire to run more extensive services and to carry out traffic operations of greater interest inevitably leads to expansion, and in making additions there is a danger of proceeding in too haphazard a manner, with the result that the layout becomes confused. When more tracks and further accessories are placed where they will fit, without giving any real thought to a general plan of operations, realistic working is quite impossible, and with every addition the resemblance to a real railway grows less instead of increasing.

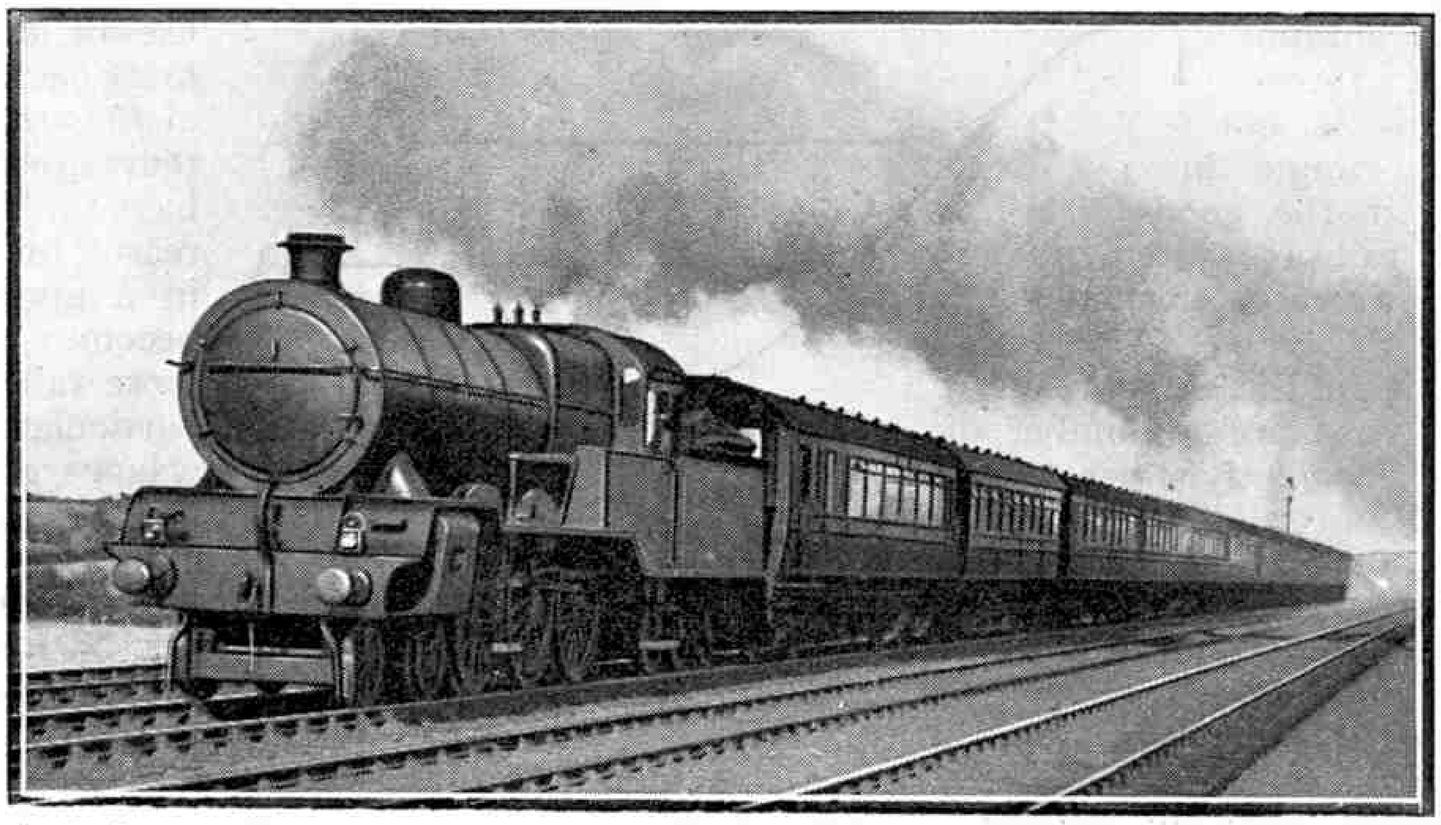
Trouble of this character may readily be avoided by working in accordance with a definite scheme. A very useful idea is to endeavour to reproduce in miniature a selected portion of the track of one of the four railway groups. A stretch of line should be chosen that is familiar to the model railway builder, or over which attractive services are maintained, and a simplified version of it laid down.

A layout formed in this manner will be a complete miniature railway in itself, but extensions may easily be made and in doing so real practice may be followed very closely. For instance, in one place a branch line may be introduced ; in another the track may be doubled ; while additional platforms or sidings may be provided at terminal stations. Planning a railway to grow naturally is by no means difficult, and at every stage in its development really workman-like operations may be carried out.

An interesting example of a model railway of this kind is shown in the diagram on the opposite page. This is based on one that actually is operated by a member of the H.R.C., slight modifications having been made in order to enable the layout to be used to show how extensions and additions may be made without giving rise to confusion.

A glance at the diagram shows that the track chosen for reproduction is that between Manchester and Blackpool. Over this section of the L.M.S. a very large number of interesting passenger trains are run, including the well-known "Club" trains that make non-stop journeys between these termini.

Perhaps the most interesting feature of the layout is the manner in which a long run is provided in a minimum space. By means of a double or "scissors" crossover, trains leaving one of the two stations pass on to an oval track, around which they may make as many circuits as may be thought necessary to represent the distance between the termini. It will be noticed that these are placed in the corners of the layout, where there is ample room for them and where they occupy space that otherwise would be found difficult to fill in a satisfactory manner.



Courtesy [*L.M.S.*

A Blackpool "Club" train at speed hauled by one of the Horwich-built 4-cylinder 4-6-0 type express locomotives of the L.M.S.

To be strictly accurate each of the two stations should be provided with its own turntable and engine shed, but for reasons of space and economy only one of each is employed. By placing them between the two terminal stations, they are made available for turning and housing locomotives stationed at "Manchester" or "Blackpool." This plan has the advantage that all points and crossings are near each other, thus making it a comparatively simple matter for one operator to work the line.

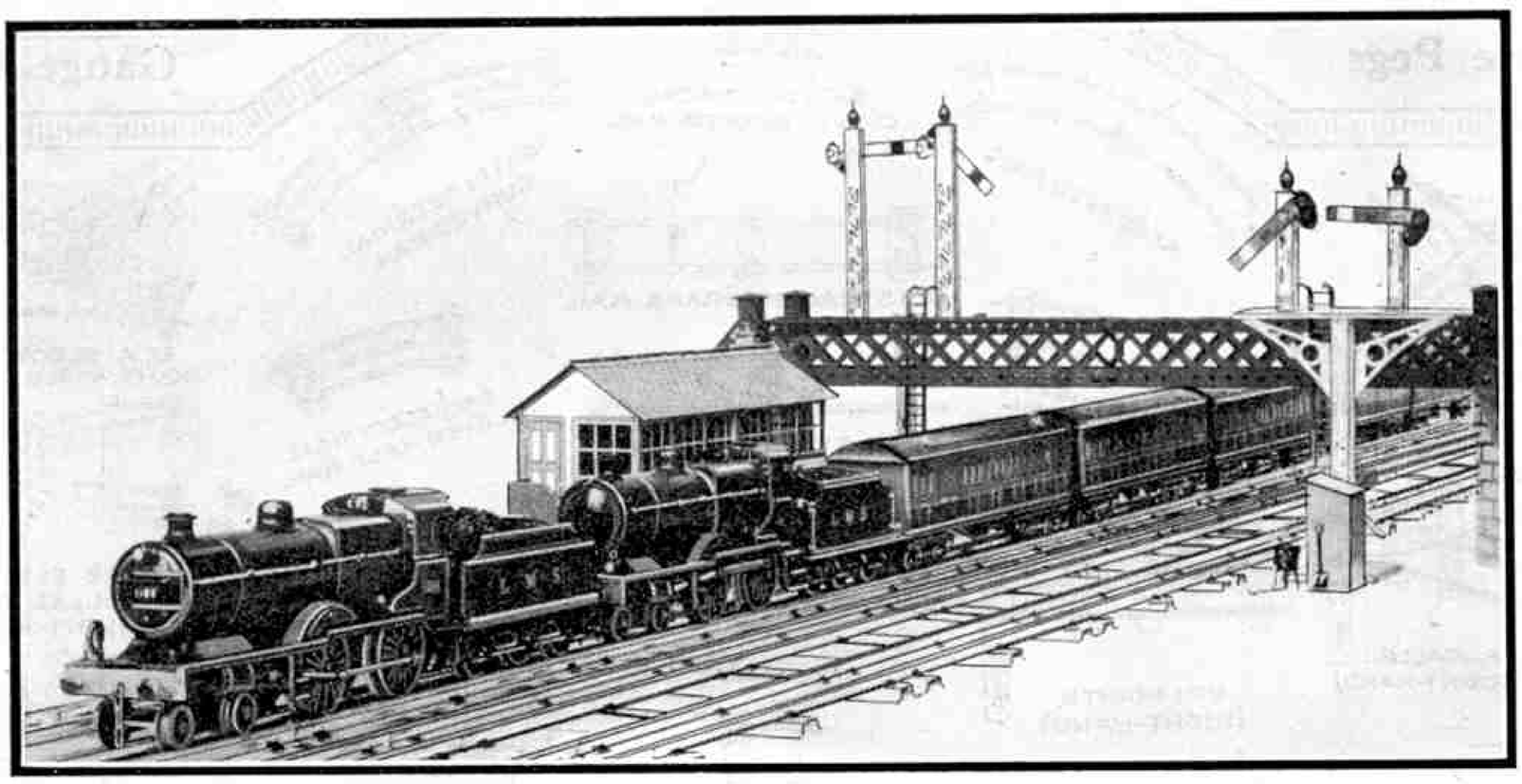
A further advantage that the compact form of the layout brings with it is that rolling stock not in use is kept in one place, and is not scattered over various sections of the track. When it is desired to introduce a new train, a great saving of time is thus effected, and it is quite easy to run a frequent service of express trains, as should be the case on a layout that represents such a busy portion of the L.M.S. system as the Manchester-Blackpool line.

A regular timetable service for express trains between "Victoria" and "Talbot Road" is maintained, and in order to see how these are worked we may follow the course

of one of them. We may suppose that a train for "Blackpool" is standing at one of the platforms of "Victoria" and that a Hornby No. 2 Special Passenger Locomotive has backed on to it. This should be the L.M.S. representative, of course, and its use will be quite correct, for Midland Standard Compounds frequently appear at the head of trains from Manchester to Blackpool. At the appointed time the train is drawn slowly out of the station and traverses the double crossover in order to reach the main line. Then it begins to gather speed and after it has made several circuits of the track the station at "Preston" comes into view.

There a halt is made, and while passengers are being set down and taken up the key of the locomotive is given the exact number of turns required to take it to "Blackpool." Leaving "Preston" behind the train then speeds on its way. Several more circuits of the track are made and then the train is switched over to the line that runs into "Talbot Road."

The run is not always made without complications, and in actual working signal checks may be met with before reaching Talbot Road. In operations on the miniature line one of these may readily be reproduced in very realistic style by means of a brake rail. This may be placed in front of the crossover, and used to bring the train to a standstill when signals are against it. A brake rail also may be used to check the career of the train on reaching the platform in the station at "Blackpool," but it is much more satisfactory to find that the locomotive has been wound just sufficiently to complete its journey.



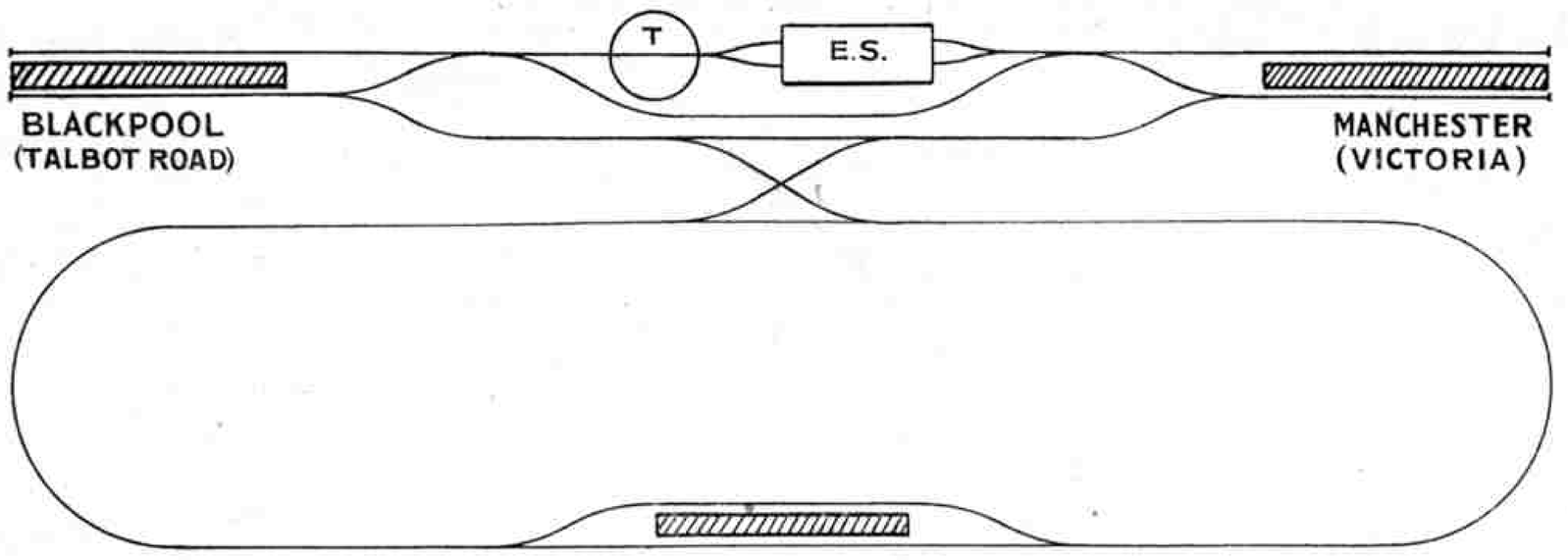
A heavy express, hauled by two Hornby Midland Compounds, running on a busy stretch of four-road track. The position of the headlamp of the pilot engine indicates that this is assisting over a portion of the journey not exceeding twelve miles in length.

Greater realism may be introduced into the operations by the introduction of additional stations. These could be made to represent Bolton, Kirkham Junction, and other important places en route. Not all trains will be made to stop at these stations, for many expresses run through to Blackpool from Manchester without stop or with a single halt. The "Club" trains are excellent examples of non-stop expresses, and at the proper time in the scheme of operations miniature trains representing them may be run exactly as is done on real railways.

On the layout illustrated, operations at the terminal stations also may be made very interesting. For example, let us suppose that the coaches that we have followed to Blackpool are to return to Manchester. The locomotive that brought them in is, of course, penned in. In order to reverse it in readiness for the return journey the train may be backed into the siding alongside the engine shed. The locomotive is then uncoupled and run on to the turntable. After it has been turned round it may then pass through the engine shed and after manipulation of the points back on to the opposite end of the train. This is then pushed to the track alongside one of the platforms of "Talbot Road."

Alternatively the locomotive may run round its train by the additional track provided. To run it through the engine shed may appear bad practice and if other locomotives are standing there it will be impossible. On its emergence the engine may be regarded as a second one, however, and treated like a locomotive beginning its day's work.

In carrying out this operation by either of the two methods the locomotive runs perilously near "Manchester," but we may suppose that the driver very carefully refrains from seeing "Victoria." The employment of a second locomotive avoids all trouble of this kind. This may be standing outside "Talbot Road" and when required is simply backed on to the train, the engine that brought this in being uncoupled. After the departure of the "Manchester" train the locomotive then remaining proceeds to the turntable, where it is turned in readiness for its next journey.



The interesting layout shown above is based on that operated by W. Binns, Blackpool (H.R.C. No. 3347). It may readily be enlarged without becoming overcrowded.

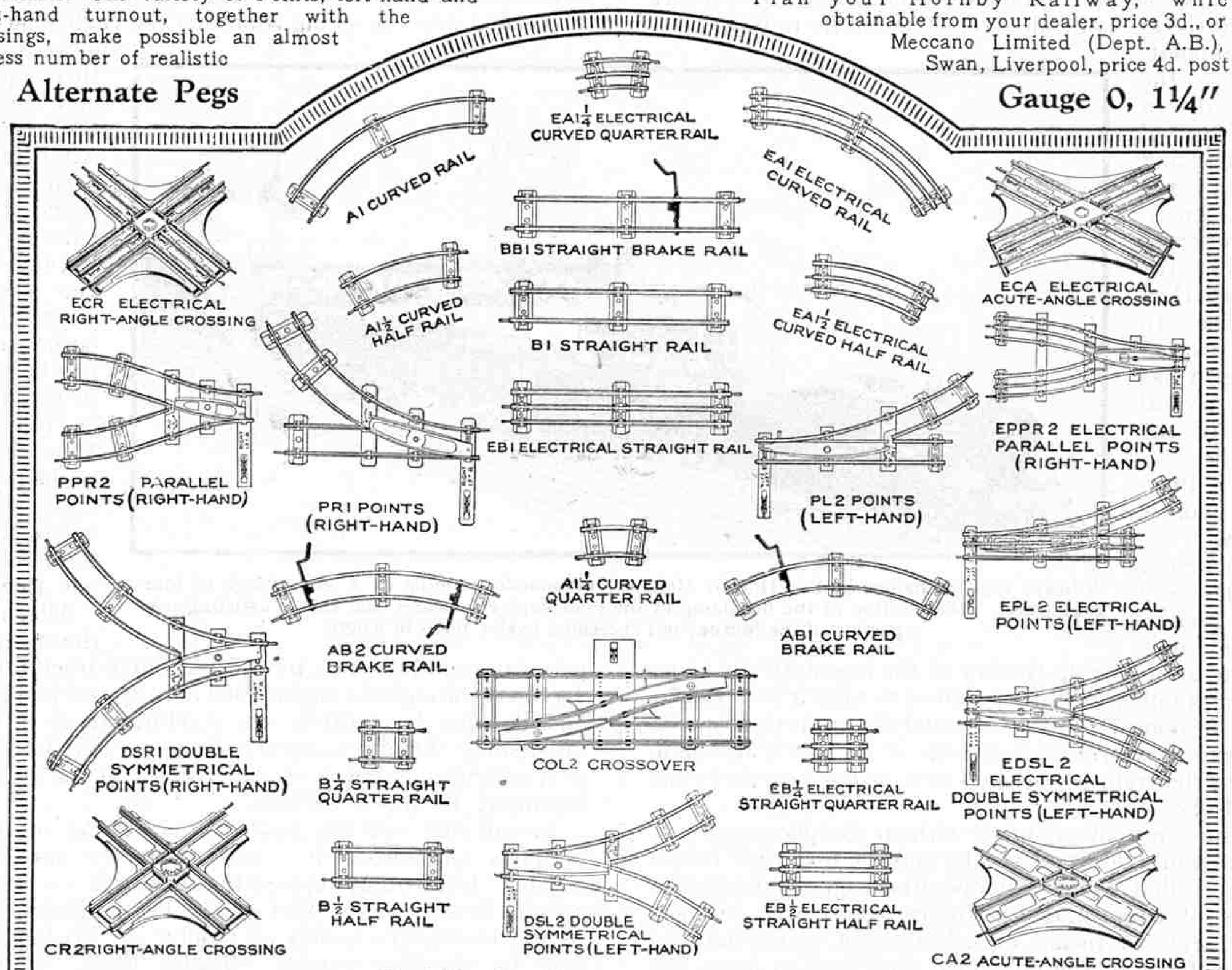
A really attractive series of express and stopping trains may be run on this layout and at weekends and holiday times their number may be increased by running specials. If goods trains also are run, then the layout will present very busy scenes and may become almost as congested as the actual railway that it represents!

Of possible additions to such a layout perhaps the most interesting and instructive is one that has been carried out by the member on whose model railway our layout is based. This is a branch line and represents (*Continued on page 432*)

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Old Swan, Liverpool, price 4d. post free.

Alternate Pegs — **Gauge 0, 1¼"**



The addition of straight and curved brake rails supplied for Clockwork Trains makes possible a great deal more fun. By the use of the straight brake rail, trains may be brought to a standstill at the station platform in a very realistic manner.

Rails for Clockwork and Steam Trains

CURVED RAILS

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right	per pair	5/-
DSL1	Double symmetrical points, left		

For 2-ft. radius curves

DSR2	Double symmetrical points, right	per pair	5/-
DSL2	Double symmetrical points, left		

PARALLEL POINTS

PPR2	Parallel points, right	... per pair	5/-
PPL2	Parallel points, left		

CROSSINGS AND CROSSOVERS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/-
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	2/-
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9
COR2	Crossovers, right hand ...	per pair	12/-
COL2	Crossovers, left hand ...		

POINTS

For 1-ft. radius curves

PR1	Right-hand points	... per pair	4/-
PL1	Left-hand points		

For 2-ft. radius curves

PR2	Right-hand points	... per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, right ...	per pair	8/6
PSL2	Points on solid base with ground disc and lamp, and adapted for Hornby Control, left ...		

STRAIGHT RAILS

B1	Straight rails	per doz.	4/-
B½	Straight half rails	„	3/-
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.
BBR1	Straight brake and reverse rails	„	1/6
DS1	Straight rails, double track ...	½ doz.	6/6
RCP	Rail connecting plates	„	4d.

Rails for Electric Trains

STRAIGHT RAILS

EB1	Straight rails	per doz.	7/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	8/-
EA1½	Curved half rails	„	5/-
EA1¼	Curved quarter rails	„	4/6

2-ft. radius

EA2	Curved rails	per doz.	8/-
EA2½	Curved half rails	„	5/-
EA2¼	Curved quarter rails	„	4/6
EDC2	Curved rails, double track ...	½ doz.	9/-

CROSSINGS

ECA	Acute-angle crossings	each	4/-
ECR	Right-angle crossings	„	4/-

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	... per pair	10/-
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

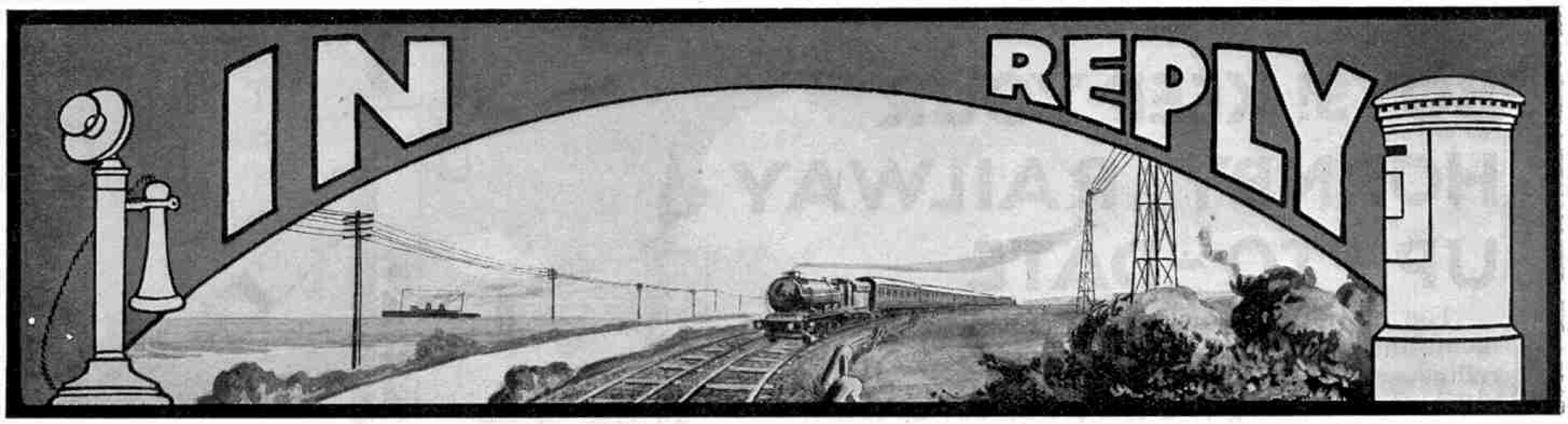
EDSR2	Double symmetrical points, right	per pair	12/-
EDSL2	Double symmetrical points, left		

PARALLEL POINTS

EPPR2	Parallel points, right	per pair	12/-
EPPL2	Parallel points, left		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL



Suggested Hornby Train Improvements

RAILS WITH REINFORCED HEADS.—Your suggestion that the connecting spikes should be continued throughout the length of the rail is interesting. We shall experiment with the idea in order to see if any real increase in strength is the result, or if any improvement in running is apparent. (*Reply to P. Braithwaite, Hastings, New Zealand*).

MINIATURE FIELD SIGNS.—Your proposal that we should introduce a set of field signs for use on a Hornby layout is quite good and will be given careful consideration. The reproduction of well known advertisements that may be seen on a long railway journey would be an aid to realism. (*Reply to F. Antonie, Manchester*).

PULLMAN OBSERVATION CAR.—Only one Pullman observation car is in operation on British railways. This is the "*Maid of Morven*," that runs on the Oban section of the L.M.S. A reproduction of a car so little used in actual practice is scarcely likely to be popular, and we regret that we cannot adopt your suggestion. (*Reply to F. D. Turner, Crieff*).

MINIATURE ADVERTISEMENTS ON GUMMED PAPER.—Miniature advertisements printed on gummed paper would be useful additions to the Hornby series of accessories. The scheme will be carefully considered and if any decision is made, details will be given in the "*M.M.*" (*Reply to W. Pavitt, Parkstone, Dorset*).

STATION LAMPS.—A realistic appearance would be given to Hornby stations by the use of lamps of the ordinary street-lamp pattern. We shall give careful consideration to your idea. (*Reply to R. Hawthorne, Coventry*).

CURVED CROSSINGS.—We do not see that any particular advantage would be gained by the introduction of curved crossings, and at present cannot consider their introduction. They could be utilised to make up a double junction, but in order to use this with our standard double track, a point of 2 ft. 3 in. radius would be required for the outer track and this is not available. (*Reply to I. Quarrie, West Norwood, London, S.E.27*).

SCENERY TRUCKS.—We quite agree that bogie wagons for conveying theatrical scenery are in common use on our railways and their introduction probably would meet with approval. Although we cannot now adopt the suggestion, it will be kept before us for future reference. For the present we recommend the use of the No. 2 Luggage Van. (*Reply to D. Cameron, Southsea*).

LOCOMOTIVES WITH LARGER DRIVING WHEELS.—The introduction of a locomotive fitted with larger driving wheels than those on the No. 2 Specials would necessitate a special design of motor and we cannot undertake this at present. Further we see no necessity for increasing the size of the driving wheels of these locomotives, for their haulage power would suffer and they would stand too high above the rails, unless their entire design were altered. (*Reply to F. T. Roberts, Bolton*).

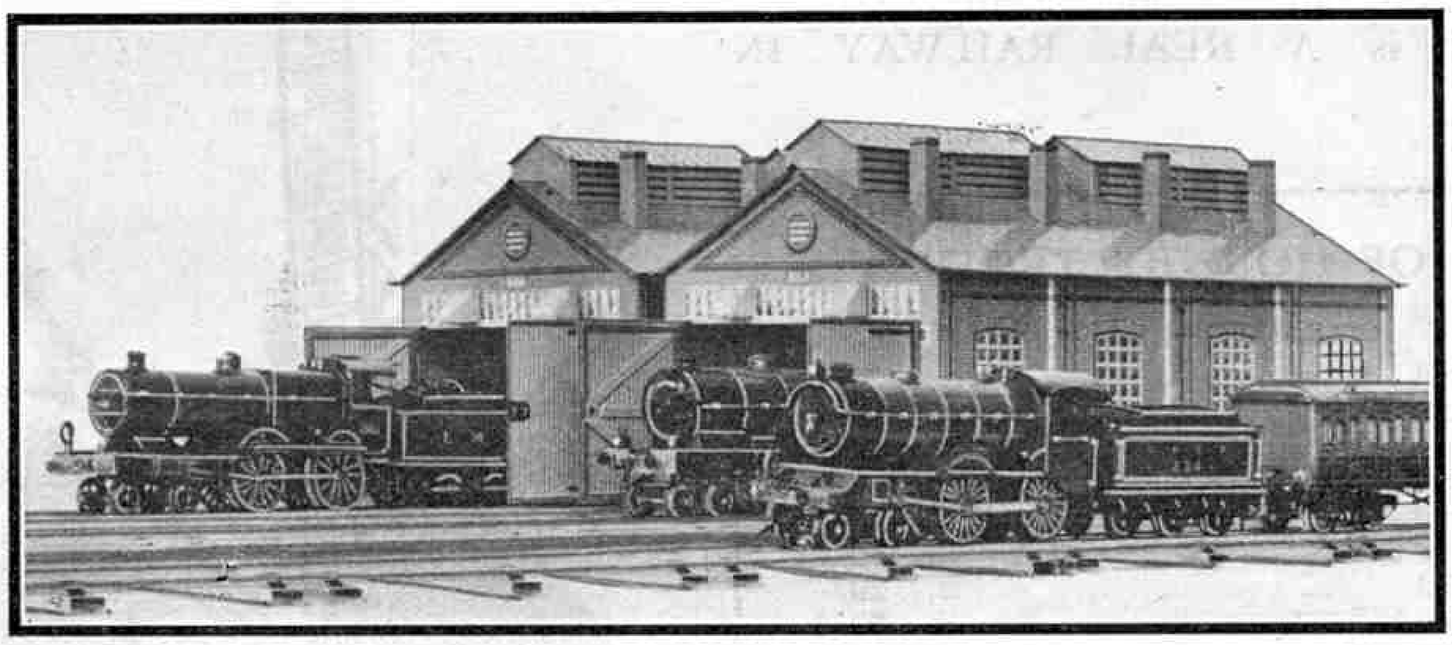
JUNCTION SIGNALS.—Your suggestion that a signal for use at junctions where the Branch line is on the left should be introduced will receive careful attention. The present junction signal is quite correct for working right hand branch lines. (*Reply to W. Shaw, Ipswich*).

WAGONS FITTED WITH BRAKES.—Your proposal that we should introduce brake-fitted wagons is interesting. It would be useful when a number of wagons are to be held on an incline and we shall consider the idea. (*Reply to A. V. Poston, Gateshead*).

FOUR-TRACK ENGINE SHED.—A four-road engine shed such as you propose would be far too expensive for the majority of Hornby Train users. The desired result may readily be obtained by placing two of the present engine sheds side by side, as shown in the illustration on this page. (*Reply to T. Hopkins, Doncaster*).

HALF LENGTHS OF DOUBLE TRACK.—Half and quarter lengths of double track, both straight and curved, would be very useful, and your proposal will be given due consideration. When a decision on the point is made details will appear in the "*M.M.*" (*Reply to T. E. Reid, Chester*).

EIGHT-WHEELED PASSENGER COACHES.—We hope shortly to introduce a double bogie saloon coach in L.M.S. and L.N.E.R. colouring. As soon as these are ready, an announcement will be made in the Magazine, and illustrations will be given. (*Reply to E. Wells, Derby*).



An interesting corner of a Hornby Train Layout. Accommodation for locomotives, of which a large number are in use, is doubled by simply placing two Hornby No. 2 Engine Sheds side by side, thus making what is in effect a very roomy four-road shed.

L.N.E.R. "MIKADO" LOCOMOTIVE.—We were interested in your design for a Gauge "0" 2-8-2 locomotive of the L.N.E.R. pattern, but such a locomotive could scarcely negotiate the standard Hornby 2 ft. radius curves. The use of locomotives of this class is not general, and reproductions in the Hornby System of other types of goods engines not yet represented would be less costly and more popular. (*Reply to C. F. Barnard, London*).

SIX-WHEELED MILK VAN.—Six-wheeled vehicles for milk traffic are commonly used on real railways, but their inclusion in the Hornby System would be difficult, for trouble would be experienced on curves of 2 ft. radius. We shall keep the suggestion before us but must point out that a van of this kind would be somewhat expensive. (*Reply to F. Cooper, Southall*).

OPEN WAGON WITH TARPAULIN BAR.—We were interested in your sketch showing a wagon with a raised longitudinal bar pivoted at each end of the wagon. Such wagons are commonly used on the S.R. and G.W.R., and the possibility of their introduction will be carefully considered. (*Reply to W. Cook, Acton, London*).

FOOTBOARDS ON GOODS BRAKE VANS.—An improvement in appearance would be effected by fitting footboards to Hornby Goods Brake Vans and other vehicles on which their use is appropriate. On revising our rolling stock careful consideration will be given to this point. (*Reply to L. Bates, Shrewsbury*).

TRUE-TO-TYPE SIGNALS AND TELEGRAPH POLES.—To reduce the size of these accessories and introduce additional details would add to their cost, and for this reason we are unwilling to effect any change at present. The idea may be put into practice at a later date. (*Reply to J. Kirk, Wolverhampton*).

NEW NAMES FOR SIGNAL CABINS.—Signal cabins with different names would be useful but their cost would be greater. When we revise our No. 2 Signal Cabin we may possibly omit the name, and this may be added by the model railway owner himself. (*Reply to J. L. H. Falls, Egham, Surrey*).

NEW POINT BLADES.—We note with interest your suggestion that our points should be constructed with switch rails and that these only should move, as in real practice. To do this would entail other alterations and an increase in price would be inevitable, but the idea will be considered. (*Reply to E. Losser and N. F. Walker, Otaki, New Zealand*).

IMPERIAL CHEMICAL INDUSTRIES TANK WAGON.—We shall give careful consideration to your suggestion that Tank Wagons lettered to represent those used by Imperial Chemical Industries Ltd. should be introduced in the Hornby System. These probably would prove popular. (*Reply to R. Bowden, Alderley Edge, Cheshire*).

MINIATURE WATER TROUGHS.—Model water troughs certainly would be realistic additions to a model railway, but they would serve no practical purpose. The water would be useless and if splashed about would not be good for the rails or rolling stock. (*Reply to L. E. Edwards, Tranmere*).

CHECK RAILS FOR HORNBY POINTS.—Check rails would serve a useful purpose, but their introduction would entail extra cost. Extensive alterations to our present rails are unlikely, but we may consider manufacturing check rails to be attached to Hornby points by those who wish to make use of them. (*Reply to H. Farringdon, Southport*).

1 FT. RADIUS DOUBLE TRACK.—We do not think that 1 ft. radius double track would prove very popular. Curved track of this radius is only used with No. 1 sets, and the demand for double track would not justify the expense. (*Reply to F. R. Weddle, Ipswich*).

LARGER TURNTABLES.—In many layouts a turntable sufficiently large to accommodate a No. 3 locomotive and tender together would be very useful. We are not likely to introduce one into the System at present, however, and suggest that you instal a triangle junction for reversing purposes. Such an arrangement, frequently used in real practice, was shown on page 57 of the "*M.M.*" for January last. (*Reply to R. A. Chester, Tonbridge, Kent*).

BRASS CENTRE RAIL FOR ELECTRIC TRACK.—We do not think that "vastly better results" would be obtained were we to substitute a brass third rail for the tinned steelplate ones now employed on Hornby electric track. A great objection to the use of track of this kind would be the greater cost, particularly of the solid rail that you suggest. (*Reply to R. O. Jones, Abergavenny*).

G.W.R. "HALL" CLASS LOCOMOTIVE.—The representation of a G.W.R. "Hall" locomotive would require a six-coupled mechanism which at the present moment is not available. A replica of the G.W.R. "Mogul," or the 2-6-0 locomotive would probably be more popular, for these may be used quite correctly on both goods and passenger trains as well. (*Reply to H. Tyler, Hereford*).

MINIATURE COAL-STACKS.—We do not propose to introduce miniature coal-stacks into the System. This accessory easily may be constructed at home by glueing pieces of washed coal on an inverted cardboard box. The top edges of such a stack should be painted white to represent the whitewash of the originals. (*Reply to H. Ward, Bristol*).

BOYS! KEEP YOUR HORNBY RAILWAY UP-TO-DATE

The big railways are constantly making improvements and additions to ensure greater efficiency in their rolling stock and equipment—so also is the Hornby railway. Boys, bring your Hornby railway up to date! The magnificent new models of L.N.E.R., L.M.S.R., G.W.R. and S.R. Locomotives are fitted with double-power mechanisms for longer runs and bigger freights. The new accessories and rolling stock are of the latest types, all built in perfect proportion and all beautifully finished in correct colours.

Playing the great game of railways with a Hornby Train is now more than ever the best fun in the world. The comprehensive range of Hornby Rolling Stock, Accessories, Rails, Points and Crossings enables a boy to duplicate almost every operation employed in modern railway practice.

All Hornby Locomotives—clockwork and electric—are thoroughly tested before leaving the factory and each one is guaranteed. The thrill and fascination of a Hornby Railway are real and lasting because a Hornby Railway is A REAL RAILWAY IN MINIATURE.

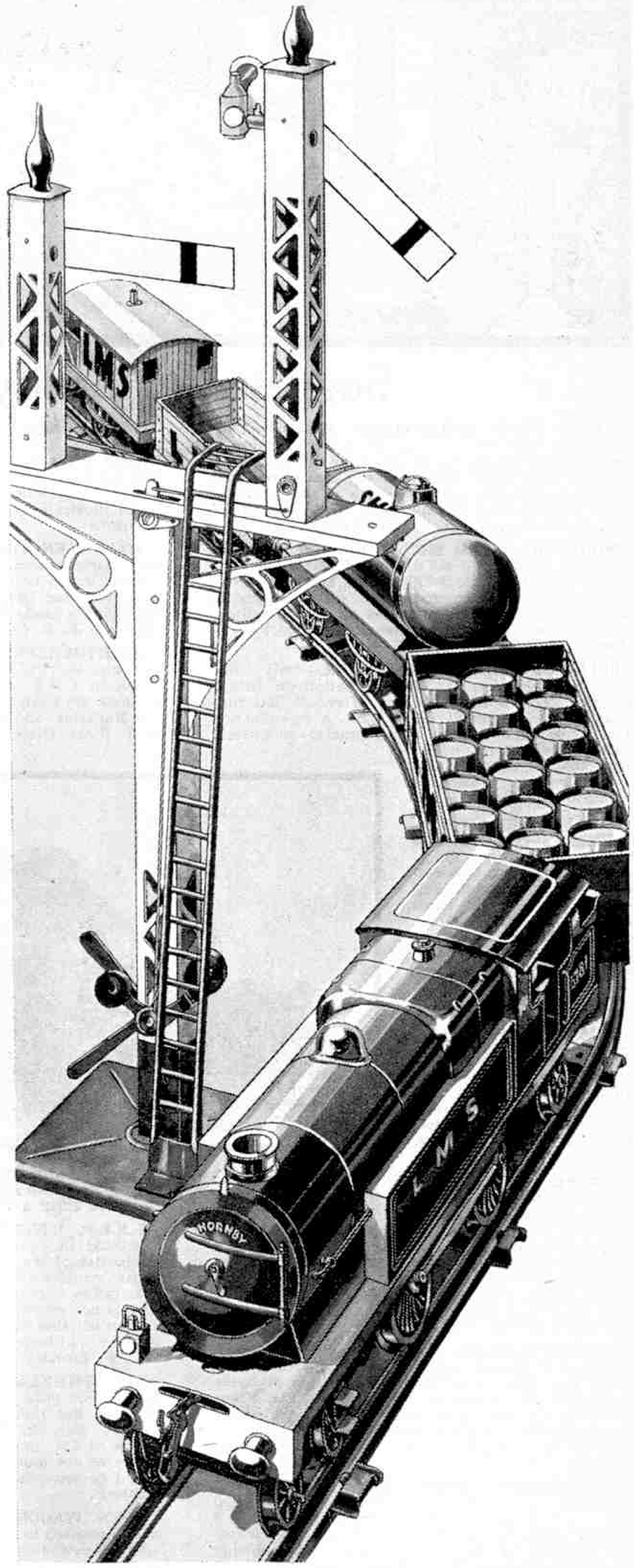
PRICES OF HORNBY TRAINS

CLOCKWORK

M0	Passenger Set...	6/–
M1	Passenger Set...	7/6
M	Goods Set	8/6
M2	Passenger Set...	9/–
No. 0	Goods Set...	15/–
„ 0	Passenger Set	15/–
„ 1	Goods Set	20/–
„ 1	Tank Goods Set	22/6
„ 1	Passenger Set	25/–
„ 1	Special Goods Set	32/6
„ 1	Special Passenger Set	35/–
„ 2	Mixed Goods Set	40/–
Metropolitan Train Set C		55/–
No. 3C	Train Set. Riviera "Blue"	62/6
„ 2	Special Pullman Set	67/6
„ 3C	Train Sets. "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Continental Express"	67/6

ELECTRIC

No. 3E	Train Set. Riviera "Blue" (6-volt) ...	80/–
„ 3E	Train Sets (6-volt). "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Continental Express"	85/–
Metropolitan Train Set, L.V. (6-volt)		95/–



HORNBY TRAINS

MANUFACTURED by - MECCANO LIMITED - OLD SWAN - LIVERPOOL

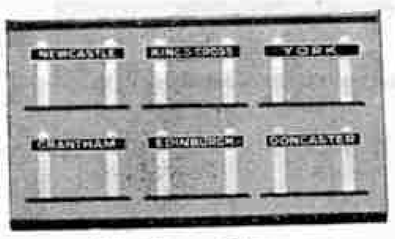
Accessories of the Hornby Series

By "Tommy Dodd"

IN planning a miniature railway a good layout is of the first importance, and an adequate number of locomotives and rolling stock is, of course, necessary in order to enable satisfactory operations to be carried out. But the smaller accessories included in the Hornby system should not be forgotten. The effect of adding to a layout these tiny reproductions of gradient posts, warning boards, fog signalman's huts and other lineside features is always very surprising, for when correctly placed these accessories give the final touch of realism to the general appearance of a model railway.

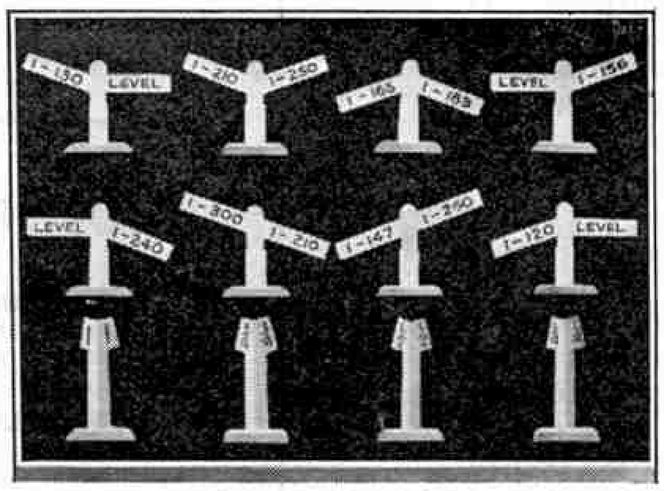
Loading Gauge

One of the most interesting of these small railway features is the fog signalman's hut, for this not only adds to the appearance of the line, but may be used in carrying out interesting operations during an imaginary fog on the layout. On real railways such a condition is often met with, and when visibility is so bad that drivers cannot see signals from a safe distance the fogmen are called out. They are stationed at points along the line near the signals in order that they may warn drivers of the positions of the arms. They do this by placing detonators on the rails to indicate that the signal is against the oncoming train. Usually they put down several in order to guard against the possibility of one detonator failing to explode. When the signal-arm falls, giving a clear line, the detonators are removed.



Station Name Boards

The task of the man who stays out in the cold and damp in order to put detonators on the line is not too pleasant, and in order to make things a little more comfortable for him he is provided with a hut in front of which there usually is a brazier or fire-bucket. In this glows a pile of red hot coke, that serves the additional purpose of showing drivers the whereabouts of the fogman.



Gradient and Mile Posts

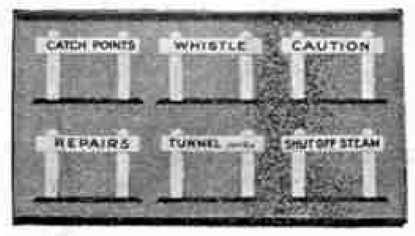
The miniature watchman's hut in the Hornby system is amazingly like the real thing. The brazier, complete with shovel and poker, also is there and the mere look of the imitation fire must be very comforting to the Lilliputian fogman who may be supposed to be stationed at the hut.

Watchman's Hut

A larger lineside feature that is shortly to be introduced is a platelayers' hut. Buildings of this kind are familiar to all travellers on railways. Usually they are strongly constructed of sleepers stood on end, and a brick fireplace and chimney is included. In the hut are stored the tools and other requirements of the men who keep the track in order. The reproduction to be included in the Hornby system is realistic in character, and will be welcomed by all those who know the addition of small lineside accessories make their layouts look like real railways.

I need scarcely remind miniature railway owners of the importance of water tanks and loading gauges. No station, however small, can be said to be complete unless these are included in its layout. To a genuine railway enthusiast even the simple operation of taking in water has a great fascination and the boilers of locomotives used on miniature railways should not be allowed to burn out for lack of water!

Station name boards also should not be overlooked. These give splendid opportunities of making both the appearance of a layout and the operations carried out on it very realistic. The six boards in the No. 9 Accessories Set have on them the names of important stations on the route followed by the "*Flying Scotsman*" between King's Cross and Edinburgh.

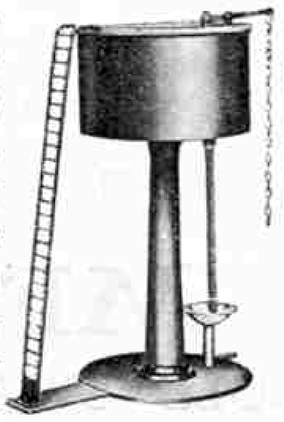


Notice Boards

Railway enthusiasts who build up really splendid layouts with well equipped stations occasionally leave the tracks between stopping places comparatively bare. There is no reason why realism should not be extended beyond the stations, for in the Hornby system are included mile posts, gradient boards, and warning signs of correct design. On real railways distance posts are erected at every quarter mile. During a journey it is very interesting to keep track of progress by checking these, for very simple calculations enable the speed of a train to be measured with a fair degree of accuracy. Even the most unobservant of railway travellers notice the posts and also become interested in the messages conveyed to them by the gradient boards. When these accessories are properly spaced along the line they add very greatly to its appearance.

Signs that warn the driver to reduce speed or to exercise caution also are included in the Hornby system and a good effect may be obtained by placing them at suitable points along the track. Some of them, for instance, those indicating the position of catch points or warning the driver to shut off steam, may be fixed permanently. This also may be done with the warning boards indicating the approach to a tunnel or instructing the driver to whistle on nearing a crossing.

Another purpose for which similar warning boards are used is to inform the driver that repairs to the line itself or to a bridge are being carried out. Naturally it is essential that he should take greater care when passing the scene of operations of this kind.



Water Tank

The Meccano Engineer's Pocket Book

Build Models from your own drawings

Every Meccano boy, being an engineer himself, should adopt the habit of taking engineering notes and sketches of interest, for by doing so he is able to get a great deal more pleasure out of his hobby. The Meccano Engineer's Pocket Book is specially suitable for this purpose. It enables a boy to make drawings of any engineering structures —Cranes, Bridges, Steam Shovels or Locomotives— that he may see on his travels and then, when he gets home, he can reproduce these structures in Meccano, guided by the drawings he has made.

Difficult to memorise details

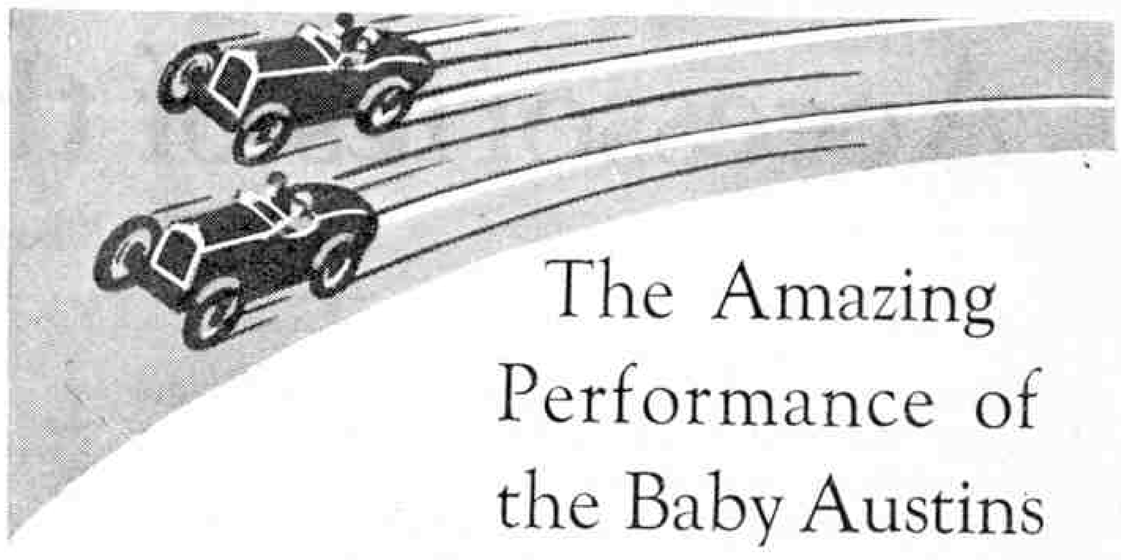
Supposing a Meccano boy is on a tour of inspection of some interesting docks, and that a cleverly designed crane catches his eye. If he does not carry a note book he tries to memorise the most important features of this crane, with a view to constructing a model of it upon his return home. In the majority of cases the memorising of engineering features in this manner leads to failure when the time comes for building them in Meccano. It is fairly easy to build a model that will perform similar functions to its prototype, but it is a very difficult matter indeed to reproduce from memory individual mechanical details.

When faced with a problem of this kind, a real engineer would immediately take out his pocket book and set to work to sketch in it all the details that he would require in order to prepare later a practical working drawing. Meccano boys are in a position to do likewise if they always make a point of carrying one of the "Meccano Engineer's Pocket Books."

The Pocket Book costs 1/–, post free, and will be sent on receipt of this amount in stamps. Write to Dept. 73, Meccano Limited, Old Swan, Liverpool.

MECCANO LTD.

OLD SWAN——————LIVERPOOL



The Amazing Performance of the Baby Austins

in last year's

ULSTER T.T.

was accomplished

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Pratts HIGH TEST AND BENZOL MIXTURE

A. Frazer Nash averaged 59.60 m.p.h.

S. V. Holbrook averaged 59.49 m.p.h.

"EASTANGLE"

Outboard Motors

Motor-Boats & Kite-Boats

KITE SPEED-BOAT, painted wood, varnished deck, 17 ins. long. Sheers away from shore like a kite on a string, turns about when you turn. **In appearance and behaviour the nearest thing to real speed-boat** yet invented. (M1) ... ... Price **4/–**

KITE STEAMER, two funnels and masts, similar in action to above, 14 ins. (M2) ... ... Price **3/–**
Ditto, much superior, 15½ ins. (M3) ... ... Price **4/–**

ELASTIC-DRIVEN SPEED-BOAT (M4), **beautiful hollow-built model** with cockpit and wind-screen, very fast, 17 ins. long, with novel quick-winding gear, fully wound in ten seconds ... ... Price **7/–**

OUTBOARD MOTOR ATTACHMENTS, fitted in one minute to any boat or piece of wood flat underneath or with straight wooden keel.

No. 1, fits any shape of boat, need not be flat, hand-driven through long flexible shaft, a fine gadget for races when paddling or bathing. (M5) Price **3/–**

No. 2, elastic-driven, very fast, with novel quick-winding gear, winding takes 10 seconds only. (M6) ... ... Price **2/–**

Boats for above Attachments

Painted and varnished Speed-Boat, 17 ins. long (M7) ... Price **3/6**
Two-funnelled Steamer, 14 ins. (M8) ... ... Price **2/–**
Ditto 16 ins. (M9) ... ... Price **3/–**

All above prices are Post Free, in Great Britain. Postage abroad extra.

All above are obtainable at high-class toy-shops and stores, or direct from us. **Please mention numbers in brackets when ordering.**

Your money willingly refunded if goods returned undamaged within a week of receipt.

EAST ANGLIAN INVENTIONS CO.

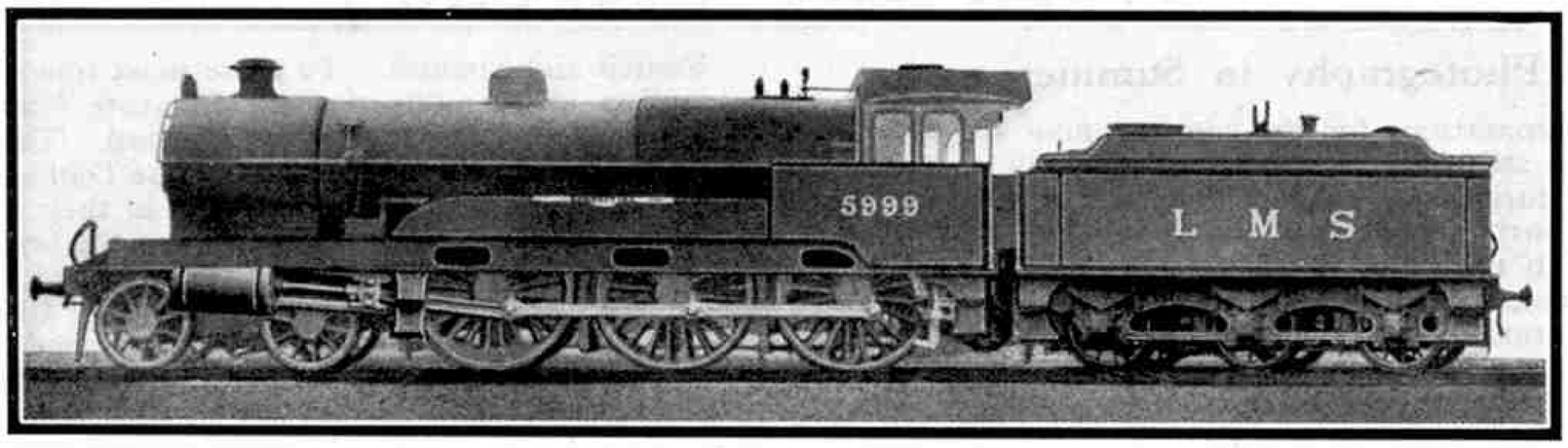
PANTILES, PAKEFIELD, LOWESTOFT

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

An Attractive Mystery Locomotive

While reading the enormous number of letters received daily at Headquarters we have often noticed the desire shown by members to combine the good points of well-known British locomotives. For instance, one keen railway critic may remark that a certain type of locomotive would be improved in appearance if it were fitted with a cab similar to that employed on the engines of another line. A second may express the opinion that an express locomotive famous for the speed with which it hauls trains of great weight would give even better performances if its boiler were changed.



The engine shown above has been formed from parts of a number of well-known British locomotives. In the interesting contest announced on this page competitors are asked to identify the engines from which these parts have been chosen.

Many of the schemes suggested by members appear to have been well thought out. On thinking them over, it occurred to us that building up new locomotives from favourite parts is quite an interesting game and we decided to play it.

The locomotive shown in our illustration is the result of this decision. Whatever members may think of the actual parts of which it is made, they are sure to admit that this is quite a handsome engine. In fact, its composite construction is so well disguised by the ready manner in which the parts fit together, that even a member of the H.R.C. could be excused if at first glance he imagined the illustration to be a genuine photograph of an existing locomotive.

For our competition this month we invite members to explain how this splendid locomotive has been built up. They should examine the illustration very carefully and try to identify each portion of the engine. Each part included in the composite is taken from an illustration of a well-known British locomotive that has appeared in a previous number of the "*Meccano Magazine.*" This ensures a reasonable chance to every member of the H.R.C., and we are sure that competitors will enjoy the thrill of tracing each part to its origin.

Entrants should give the name of each portion, and opposite this sufficient detail to identify the class of locomotive from which it is taken. For instance, the front bogie forms one complete section, and in a correct return the origin of this would be given as "L.M.S. 4–6–0 Locomotive, 'Prince of Wales' class."

The contest will be divided into two sections—Home and Overseas. To the four competitors in each section who send in the most complete lists showing the origin of the parts used in designing the composite locomotive, Hornby goods (or Meccano if preferred) to the value of 21/–, 15/–, 10/6 and 5/– will be awarded.

A number of consolation prizes also will be given. These will be awarded to the competitors whose entries are next in order of merit, and no member should refrain from sending in his entry because he thinks it is incomplete. In the event of two entries being equal in regard to completeness and correctness, neatness will be taken into consideration in making a final decision. Envelopes should be clearly marked " H.R.C. Mystery Locomotive Contest." Entries in the Home section should reach Headquarters at Binns Road, Old Swan, Liverpool, on or before 31st May, and the closing date in the Overseas section is 30th August. Every competitor should take care to mark his entry with his H.R.C. number.

A New Drawing Contest

One of the most wonderful sights in the world is that of an express train running at high speed. Even when travelling along a level track such a train gives a splendid impression of speed and power, but undoubtedly the finest effect is produced when the locomotive is pulling a heavy load up an incline. The fireman then is doing his utmost and, if there is a following wind, a thick column of black smoke is piled up above the funnel of the engine.

A train in motion is the subject of our competition this month. In this we ask competitors to submit a drawing that gives their impressions of such a scene as that we have described. Drawings may be in pencil, ink or in colour, and the train depicted and its position are left entirely to the discretion of competitors. Their drawings may show a well-known express climbing steep banks or local trains enjoying a burst of speed between stations, and each entry will be judged entirely on its own merits.

We are looking for particularly good entries from Overseas readers, for this competition will give many of them splendid opportunities of submitting drawings of powerful locomotives of unusual types climbing the steep grades that are so often found on their railways.

The competition will be divided into the usual sections—Home and Overseas. In each division prizes of Hornby railway material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 will be awarded to the senders of the four entries that are judged to be the best. In addition a number of consolation prizes will be awarded to other competitors whose entries are specially worthy of recognition.

Envelopes should be clearly marked " H.R.C. Train Drawing Competition " and must be despatched to reach Headquarters of the Hornby Railway Company at Binns Road, Old Swan, Liverpool, on or before 31st May, 1930. The closing date for the Overseas Section is 30th August, 1930. Every entry must be clearly marked with the competitor's H.R.C. membership number.

H.R.C. Competition Results

HOME

March "Second Name and Number Contest."—First: H. W. Kyte (15679), Ilford, Essex. Second: R. I. Lewis (15257), Gloucester. Third: D. J. W. Brough (8246), Cheam, Surrey. Fourth: H. Ainsworth (1599), London, N.W.7. Consolation Prizes: J. W. Lowe (9030), Port Talbot, S. Wales; A. F. Williams (5663), London, N.8; W. G. Batteson (8531), Watford; C. L. Jones (29), Nantwich; G. Burbidge (6214), London, N.1; G. Hobday (11451), Eastbourne.

March "Safety First Contest."—First: M. Dent (14899), Penge. Second: A. E. Murray (4524), Wigan. Third: R. G. Fanshawe (2936), Northwood. Fourth: L. R. N. Mills (7296), Dorchester. Consolation Prizes: K. S. Kirby (2000), Redcar; C. Reid (15063), Glasgow; L. Mansfield (3909), Withernsea.

With the Secretary

Club Photography in Summer

In most clubs preparations for the summer now are well advanced, but there is still time to make arrangements for keeping members together during the outdoor season. A summer programme fulfils two purposes; it ensures a good start when regular meetings in the club room commence in the following autumn, and it gives members ample opportunity of obtaining healthy exercise in the open air. These advantages are well appreciated in practically every club and from secretaries' reports I find that many interesting programmes have been arranged.

Plans for the summer are very varied in character. Cricket features very prominently in most of them and I am glad to find that those who took my advice to make early preparations have not been disappointed, but have secured an interesting fixture list. Many clubs are arranging a camping season and in other cases members are looking forward to long rambles and cycle runs.

Given fine weather the coming summer should be a record for Meccano club activities. Even if the weather is unfavourable—and it does occasionally rain, even in an English summer—there is always the club room to fall back upon. There members can enjoy indoor games or, if they wish, turn their attention to model-building or make alterations in the general arrangements of their headquarters.

One thing to which I am looking forward is receiving many interesting pictorial records. In practically every club there is at least one member who is the owner of a camera, and I hope that as many snapshots as possible of members engaged in summer pursuits will be secured and forwarded to me. The best of these will be published in the Magazine and 5/- will be awarded to every club that secures representation in this manner.

Guild Literature in Dutch

During the past winter membership of the Meccano Guild increased by leaps and bounds, and the steady growth of the organisation is a splendid testimony to its success in uniting Meccano enthusiasts. Probably the most remarkable feature of the Guild is the world-wide nature of its popularity. There has been a remarkable increase in the number of new members enrolled from all parts of the world and expansion has been equally noteworthy in countries as remote from each other as the Argentine Republic in the South, Norway and Sweden in the North, and China and Japan in the Far East.

In recent years the progress of the Guild in Spain, the Argentine Republic, and other Spanish-speaking countries has been so rapid that it has been found necessary to print Spanish editions of all Guild literature. This step brought the number of languages in which the Guild forms and leaflets are printed to three—English, French and Spanish. To these must now be added Dutch. The realism of "Engineering in Miniature" appeals strongly to the practical minds of the boys of Holland. They have formed several promising clubs and are joining the Guild in such large numbers that supplies of literature printed in their own language have become essential. Leaflets explaining the origin and purpose of the Guild, together with forms of application for membership, all printed in Dutch, are now available and these are being sent to all those in Holland who are interested in the organisation.

Guild leaflets and forms in Dutch also will be appreciated in the Dutch East Indies, a quarter from which many keen members of the Guild have been recruited.

Meccano Club Secretaries
No. 19. Mr. S. A. S. Royan

Mr. Royan has been secretary of Excelsior(Madras) M.C. since its foundation. It was largely through his efforts that the club secured affiliation in June, 1926. Lectures and Model-building Contests are the chief features of the programme followed by the club and membership is steadily increasing.

The Correspondence Club

In addition to the literature mentioned, application forms for the Correspondence Club also are being printed in Dutch. These will encourage Guild members in Holland to join the already large number of Meccano boys in all parts of the world who keep in touch with each other by the exchange of letters.

The influence of the Guild has spread to countries far distant from each other, but the Correspondence Club has broken down the barrier of distance and through it many firm and enduring friendships have been made. One particularly interesting case that I noted recently is that of a New Zealand member who is conducting with a friend in England a cordial correspondence that began more than seven years ago. This is by no means an isolated instance. I hear constantly from members to whom such correspondence has been a source of the greatest pleasure for similar periods and cases have been brought to my notice in which visits have been interchanged by members who became acquainted with each other through the medium of the Club.

* * * *

I have been asked to announce that on 10th May, 1930, an Exhibition is being held by the St. John's (Oval) M.C. in St. John's School, Camberwell New Road, London, S.E.5. This will be open at 6 p.m., and there is no charge for admission.

Proposed Clubs

Attempts are being made to start clubs in the following places and boys interested should communicate with the promoters whose names and addresses are given below:—

LONDON—D. Archer, 27, Hafton Road, Catford, S.E.6.
LONDON—H. Moyer, 99, St. Stephen's Avenue, Shepherd's Bush, London, W.12.
NEWPORT—K. R. Johnson, 19, Windsor Terrace, Newport, Mon.
PORTUGAL—John Wallace, 7, T. do Rosario 1°, A. Algeria, Portugal.
SOUTH AMERICA—V. L. Noguera, Paraguay St. No. 22403, Buenos Aires, Argentine.

CLUB NOTES

Attenborough Choir Boys' M.C.—The subject of a recent Model-building Contest was a road transport vehicle of any type. Entries were of a very high standard, three scoring full marks. A Debate on "*Gramophones v. Wireless*" was fiercely argued, the contest continuing for nearly two hours. The majority favoured the gramophone. A Lecture on "*Internal Combustion Engines*" was given by the father of one of the members and afterwards the lecturer answered a number of questions from keenly interested members. Club roll: 14. *Secretary:* G. W. Render, Attenborough Lane, Chilwell, Notts.

Harpenden and District M.C.—The second Annual Exhibition and Concert attracted an attendance of about 60 people, who were greatly interested in the models on view. These included the High-speed Ship-Coaler, Dockyard Crane, Stiff Leg Derrick and a Dragline. During the Concert a First Aid Display was given. Club roll: 25. *Secretary:* A. Buck, Station Road, Harpenden.

Greenford M.C.—On Model-building Evenings special attention has been given to various types of cranes. A section for drawing is an attractive new feature. A group of members visited the South Kensington Museum, and afterwards saw "*The Sleeping Beauty*" at Drury Lane, where they greatly enjoyed the Meccanoland scene described in the January issue of the "*M.M.*" Club roll: 9. *Secretary:* C. Howe, 145, Coston's Lane, Greenford.

Great Baddow M.C.—The Model-building Contests continue to produce excellent models, those made by junior members being particularly good. The President, Dr. Spencer Phillips, gave a Lantern Lecture on "*Aircraft*," the slides for which were kindly loaned by De Havilland Aircraft Ltd. The older members are interested in gardening work and took part with the Leader and Assistant Leader in an interesting discussion on this subject. Club roll: 47. *Secretary:* Miss D. K. French, High St., Great Baddow.

Blyth Y.M.C.A. M.C.—Splendid progress is being made and membership is increasing rapidly. At every meeting a paper on a subject of interest is read, members taking it in turn to give these. A very successful Concert was given, at which tea was provided and the prizes earned in Model-building and other Contests were distributed. Club roll: 14. *Secretary:* W. Clapham, 9, Dalmatia Terrace, Blyth, Northumberland.

Brades M.C.—In a Model-building Contest recently organised the entries were so well designed and constructed that the judge had difficulty in making a decision. A Lathe constructed by Joseph Leedham, aged nine years, secured 1st prize, and the 2nd and 3rd were won by F. Rudd and J. Sheldom respectively. Club roll: 52. *Secretary:* Geo. Evans, 148, West Bromwich St., Oldbury.

Horsforth M.C.—On Model-building Evenings members are required to build the model named on a slip of paper drawn from a hat. A Hobby Night proved very successful, a wonderful display of Meccano, Hornby Train and Fretwork Sets, and outfits for other indoor recreations, being brought to the club room by members. The Hornby Train Section has now become a Branch of the H.R.C. A Magazine has been started and an interesting Library is being formed. Club roll: 28. *Secretary*: J. K. Sutcliffe, Atlas House, Horsforth, Nr. Leeds.

Ipswich M.C.—Members built many excellent models suitable for display at Exhibitions. The chief of these were a Meccanograph and a Meccano Flashing Sign. The Secretary gave a Lecture on "*Camping.*" The club Library now contains 22 books and more are being added. At one meeting articles in recent issues of the "*M.M.*" were read and discussed. Club roll: 12. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.

Dunoon District M.C.—A "Hat" Night was held, topics for short talks being drawn by all members present. Interesting accounts were given of such subjects as "*The Principles of the Meccano Guild*," "*Your Personal Views on Homework*," and "*The Objects of the League of Nations.*" A Table-Tennis Night and a Hornby Train Evening were well organised and at other meetings Debates and an Exhibition of models have been held. A Contractor's Night also proved very popular. Club roll: 23. *Secretary:* Wm. D. Laird, "Parkroyd," Victoria Road, Dunoon.

Oxford Central School M.C.—Mr. D. G. Perry, B.A., Headmaster of the School, has kindly consented to become President of the club. Members have visited the G.W.R. Works at Swindon. An extensive Hornby Train Layout has been fixed on a large baseboard, several Bridges, a Tunnel and two Stations being included. Club roll: 21. *Secretary:* P. C. Bosworth, 72, Walton Street, Oxford.

Alton M.C.—One member gave a talk on "*Liners*," explaining their construction and gave an account of his own experience on board one of them. A Debate was held on the question "*Will Air Traffic supersede Surface Transport?*" The majority of those present voted in the negative. Special Transport, Crane and Mechanism Evenings have been held. On each occasion suitable models were constructed as illustrations. It has been decided to invite non-members to Lantern Lectures, and a small charge is to be made. Club roll: 16. *Secretary:* G. Chesterfield, 82, Normandy Street, Alton, Hants.

Chelmsford M.C.—A Visitors' Night has been held. A large number of excellent models were constructed and these were greatly admired by visitors. A mystery pie was made, to be presented to the visitor who guessed its contents. Each entrant paid 2d. for the privilege, but no one was successful. This is not surprising, for the pie contained nothing but salt! Mr. F. Harvey, an honorary member of the club, gave a valuable talk on model construction, explaining how strong and rigid structures of various kinds could be built. Club roll: 49. *Secretary:* Miss G. Flexman, Saracens Head Tap, High St., Chelmsford, Essex.

Churchill M.C.—Has now been affiliated to the Guild and is making splendid progress. At one meeting, Mr. C. E. Blake, the Leader, gave an interesting talk on "*R.100*," illustrating the construction of the airship by means of blackboard sketches. A discussion on the merits of the giant locomotives of the four British railway groups was extremely lively. A lecture on "*Flints*" was given by Mr. E. Ward, who exhibited specimens found by himself. Excellent club models built include a Swivelling Crane, a Steam Boat and a reproduction of Stephenson's "*Rocket.*" The Leader is instructing members in Boxing, and at the end of each meeting a few minutes are devoted to this sport. Club roll: 16. *Secretary:* A. Blake, The School House, Churchill, Oxford.

Castle Douglas M.C.—Members have spent many jolly evenings in Model-building and Games. Recent constructional work has included the building of bridges for use on the Hornby Train Layout. Members are now busy overhauling their outfits and re-enamelling parts. Club roll: 28. *Secretary:* Mr. Peter Thomson, 106, Queen St., Castle Douglas.

Mall School M.C.—Model railway night was a great success, and a speed contest for locomotives proved enjoyable. Lectures by members have included an interesting talk on Southampton in which the liners and docks were fully described. Club roll: 17. *Secretary*: H. T. Simpson, 23, Seymour Rd., Hampton Wick.

Belgrave M.C.—Contests of many types have been held, including Model-building and Essay Competitions. Rambles and Cricket matches are being arranged and a day camp organised. Club roll: 10. *Secretary*: K. J. Hatfield, 25, Acorn Street, Melton Road, Leicester.

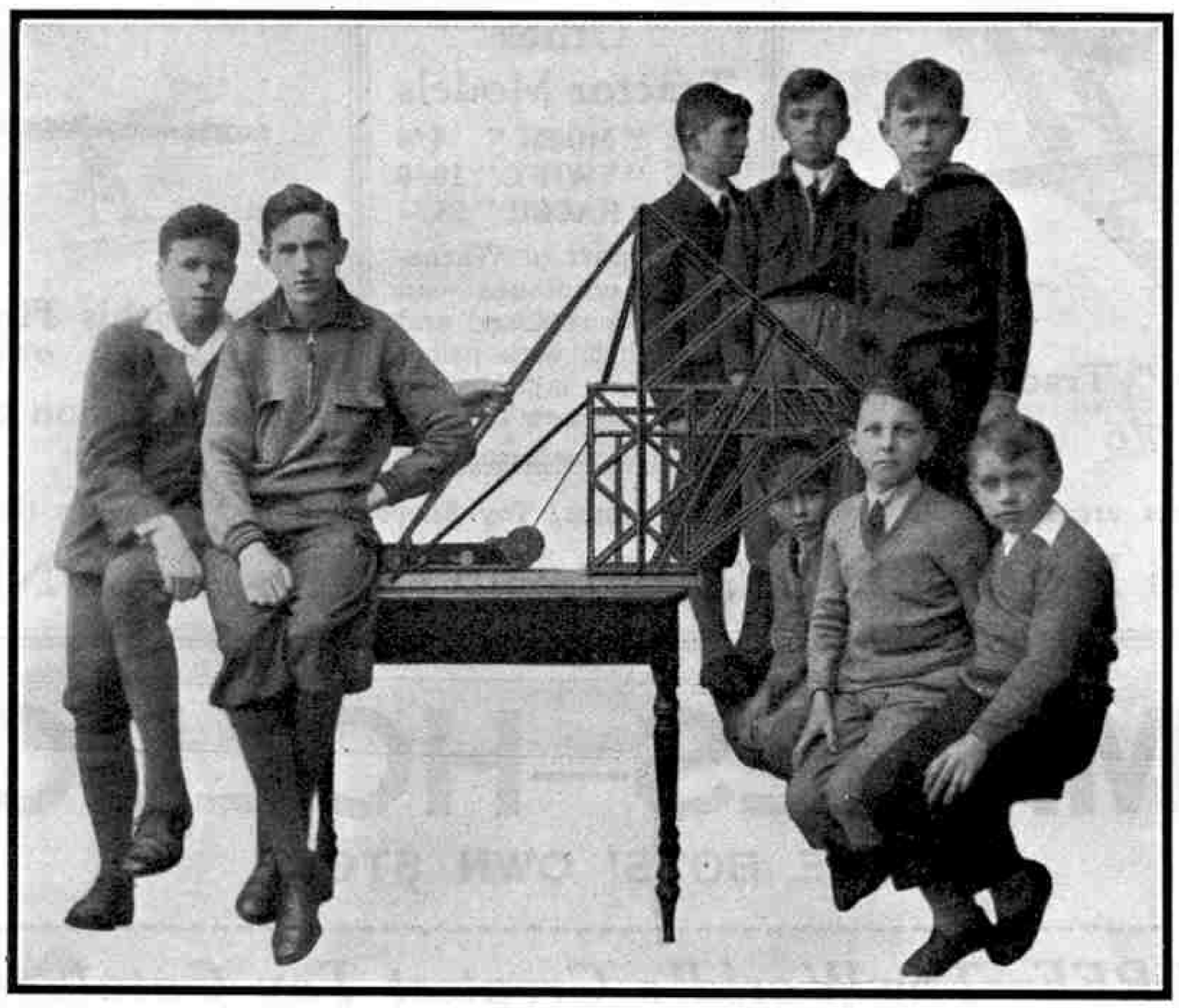
Tynecastle School M.C.—A visit was paid to a local Printing Works by members, who were greatly interested in the printing of cheque books and notes. A huge camera used in process work attracted close attention. A large and realistic club model of the Forth Bridge has been constructed. Club roll: 55. *Secretary*: Wm. Urquhart, West Mill Road, Colinton, Edinburgh.

St. Martin's (Nottingham) M.C.—An Entertainment Evening was devoted to conjuring tricks, and at another meeting moving pictures were shown by means of a Baby Ciné. A very successful Exhibition has been held, at which a Meccanograph loaned from Headquarters was the chief centre of attraction. Club roll: 18. *Secretary:* S. Langford, 67, Edward's Lane, Sherwood, Nottingham.

Westbury M.C.—The First Annual Exhibition attracted a large number of parents and friends. The models constructed by members for this display were of a very high standard and visitors freely expressed their appreciation. Two Cinema Displays were given, the films shown being kindly loaned by Morris Motors Ltd. No charge for admission was made, but a collection realised more than £1. Club roll: 34. *Secretary:* E. D. Moye, 24, Burnell Rise, Letchworth Herts.

Downend M.C.—Good progress is reported and several new members have been enrolled. Meetings have included a "Do As You Like" Night and Model-building Evenings. A Hornby Train Layout also has been built and interesting operations of a realistic type carried out on it. Club roll: 20. *Secretary:* G. Bailey, Downend Farm, Downend, Nr. Bristol.

Galashiels M.C.—The Third Anniversary was celebrated by a Social in the gaily decorated club room. Most of the evening was devoted to Games, and Refreshments were provided. A Lantern Lecture on "*The Railway Centenary*" was very interesting. Members built a Steam Shovel and other large models, and these were displayed in the window of a local dealer. There they proved a great attraction and crowds of people gathered round the window to look at them. Mr. R. Croall, Leader of the Edinburgh M.C., visited the club to give a talk on his tour of the Meccano Factory. Club roll: 26. *Secretary:* D. Richmond, 58, St. John Street, Galashiels.



Members of the Odin (Denmark) M.C. demonstrate the strength of a crane they have constructed. This club was affiliated in March 1928, and has made splendid progress under the able guidance of Miss A. Jenson, the Leader, assisted by Andreas Thiele, the secretary, who is on the extreme left of our photograph.

Australia

Sutherland M.C.—An Electrical Evening and a Mock Trial have been held. At one meeting good practice in Morse Signalling was obtained by means of a Meccano Morse Tapping Key. A Puzzles Night also proved very interesting, the Secretary supplying a large number of "teasers." The Meccano Lecture, "*Lives of Famous Inventors*," greatly interested members. Club roll: 11. *Secretary:* P. O'Connor, "Burrendong," Tamar St., Sutherland, N.S.W.

China

Swatow M.C.—Members are very keen on Model-building and on readings from the "*M.M.*" A Fretwork Set has been obtained. A few minutes at the close of each Model-building Evening are devoted to Games. Club roll: 11. *Secretary:* H. J. Chan, P.O. Box No. 34, Swatow.

India

Excelsior M.C.—In an interesting Model-building Contest for junior members, the parts in a number of outfits were equally distributed among competitors, who built from them models of their own design. These included excellent representations of a travelling Crane, Motor Lorry, Roundabout and Windmill. The club room is open every evening except Saturday, and each member in turn gives a Lecture on a subject chosen by himself. Club roll: 20. *Secretary:* Mr. S. A. S. Royan, Senji House, Komalesvarenpett, Mount Road P.O., Madras.

Lahore M.C.—Interesting Lectures have been given by the Leader on "*Railway Work*," and by the Secretary on "*Wireless Reception.*" Model-building Contests have been held regularly and members greatly enjoyed a Garden Party. Club roll: 9. *Secretary:* Mr. K. Singh, 6, Nisbet Road, Lahore.

South Africa

Malvern Wesleyan M.C.—Meetings have been devoted to Model-building, Lectures, Talks and Visits to places of interest. A "Hat" Night was highly successful, several excellent talks on subjects of interest being given. Models constructed by the members of the club have been displayed in the window of a large Johannesburg store, where they have attracted much attention. Games have included Swimming, Cricket, and Cross-country Runs by moonlight. Members entertained a large number of children at a party, and for themselves arranged a Fancy Dress Social. Leader:—Mr. E. Sykes, P.O. Box 8, Cleveland, South Africa.

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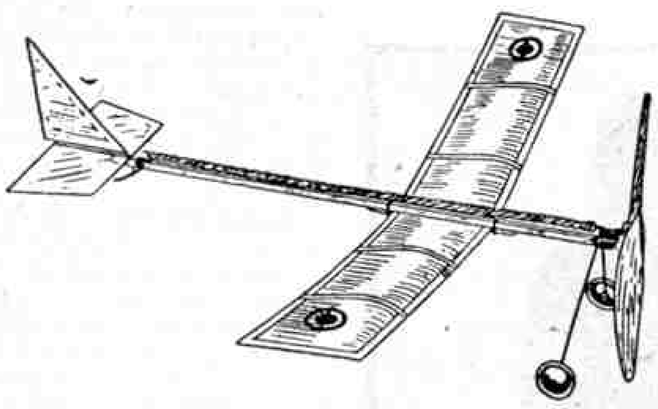

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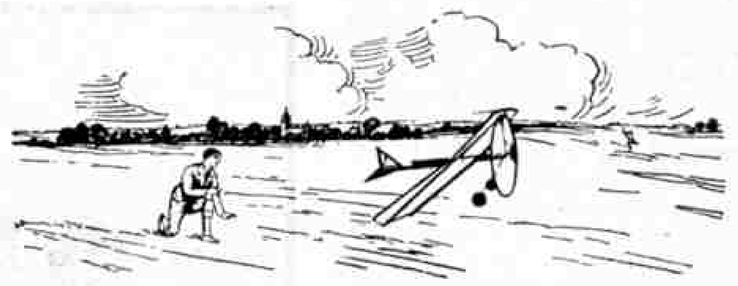

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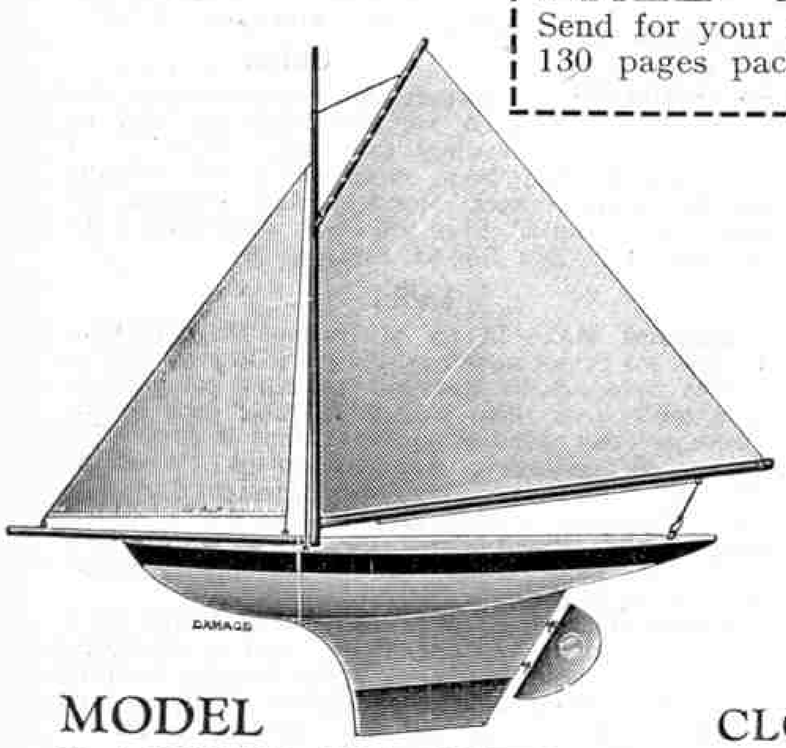

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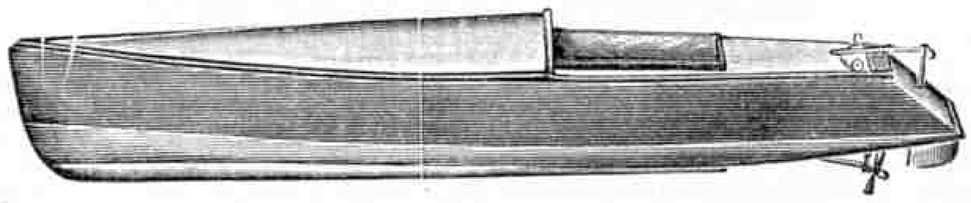

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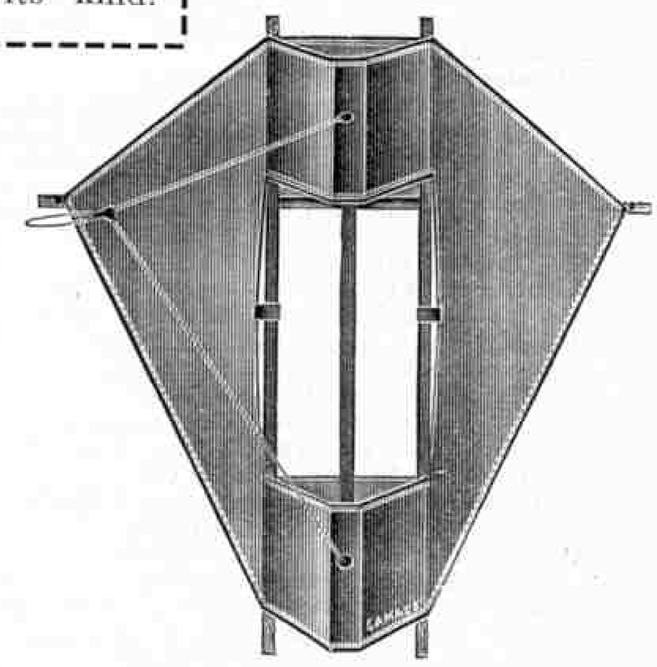

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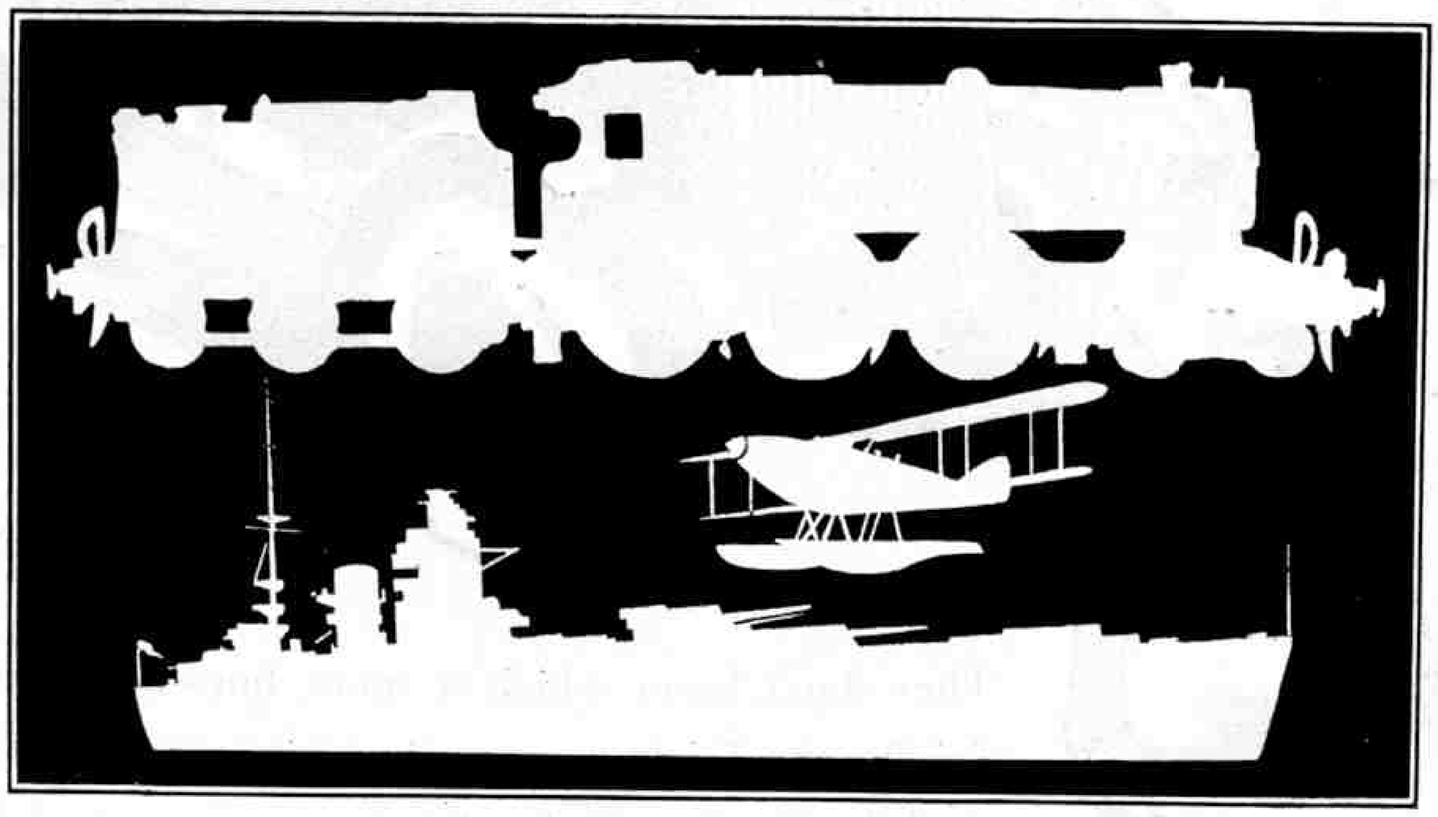
Competition Page

"CUT OUTS"

A FEW days before the close of the 30th Drawing Contest a very novel entry reached us from a reader in Cumberland, Leslie Prior, of Workington. It took the form of a "cut out." Instead of outlining his battleship and sketching in the details in pencil, Prior had cut out the design from paper with a pair of scissors, to secure a silhouetted effect. We understand that this novel idea has been our reader's hobby for some time—he is only 12 years of age now—and for our inspection he also sent cut out specimens of aeroplanes, breakdown cranes, locomotives, ocean liners, motor boats and motor cars and lorries.



After careful consideration we decided that the entry scarcely came within the scope of the conditions of the 30th Drawing Contest, but the idea seems to us so strikingly novel that we have decided to run a special competition with paper "cut outs" as the subject.

Our illustration shows the type of work that can be done with no better tools than an illustration to copy, a piece of plain paper, a pair of scissors and a pen knife. Of course, the possibilities are not limited to the "cut outs" we show, or to the other suggestions gleaned from the specimens submitted by Prior. Birds, flowers, animals, human beings, buildings, and, in fact, most things are suitable for treatment in this way.

Competitors may submit as many entries as they wish, but no competitor may win more than one prize.

To give our younger readers an opportunity to excel, the entries will be divided into two sections, A for those from readers aged 16 and over, B for entries from readers under 16. Prizes of Meccano or Hornby Trains (the winners' own selection) to the value of 21/– and 10/6 respectively will be awarded to the senders of the best and second best entries in each section. In addition, there will be a number of consolation prizes.

In view of the fact that young boys rarely are skilled in the use of scissors, we have decided that it is permissible for them to enlist the aid of their Mothers and Sisters in the actual cutting out. It is not necessary to mount the "cut outs" on black card before sending them to us, although this may be done if the entrant wishes.

Entries should be addressed to "Cut Outs," Meccano Magazine, Binns Road, Old Swan, Liverpool, and sent to reach this office not later than 31st May. Overseas closing date, 30th August.

Every competitor must write his name, age and full address on the back of every entry submitted by him.

Competitors may have their entries returned if a stamped addressed cover of suitable size is sent for the purpose.

May Photographic Contest

In accordance with the announcement in our last issue, our photographic contests this year do not require competitors to submit photographs of any special subject, and the monthly contests are simply for the best photographs submitted each month, irrespective of their subjects.

The entries to the competitions will be divided into two sections, A for those from readers aged 16 and over, B for those from readers under 16. Prizes of photographic materials or Meccano products (to be selected by the winners) to the value of 21/– and 10/6 respectively will be awarded to the best and second-best entries in each section.

Each competition will be known under the name of the issue in which it is announced. Thus all entries sent this month should be addressed to "May Photo Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool." They must reach this office not later than 31st May. Overseas, 30th August.

Competition Results

HOME

Jungle Escape.—1. P. A. Brown (Repton, Derby); 2. A. M. Johnston (Dunstable, Beds.); 3. H. V. Parkin (Sutton, Surrey); 4. R. Gordon (Stirling). Consolation Prizes: E. M. Crabtree (Scarborough); R. H. Fieldhouse (Hitchin, Herts.); E. V. Fisher (Sheffield); M. Macdonald (St. Andrews, Fife); A. L. Mosley (Manchester); H. Rushworth (Accrington); B. Shipley (Walsall).

A review of this contest will appear on the closure of the Overseas section.

30th Drawing Contest.—Every conceivable type of naval vessel was featured in this contest: battleships, battle cruisers, aircraft carriers, motor launches, destroyers, cruisers, supply ships, submarines, and even torpedo-carrying seaplanes. The contest truly was a Grand Review, and right from the commencement our judges found themselves in difficulties in endeavouring to allot the awards.

Eventually the following awards were made, the first and second prizes in the A section being lumped together and augmented to make two equal first prizes and special third prizes added in each section:—

First Prizes: Section A, R. Forrester (Carlisle); N. Shacklock (Manchester); Section B, N. Alford (Carlisle); Second Prize: Section B, W. N. J. Pett (Newton Abbot); Third Prizes: Section A, C. J. Keates (Dulwich, S.E.21); Section B, H. Button (Lutterworth). Consolation Prizes: G. V. Heron (Ballywalter, Co. Down); O. A. Kimmings (East Acton, W.3); L. T. Levitt (Sketty, Swansea); R. C. Randall (St. Albans); E. Wilcox (Birmingham); J. H. Wood (Prestatyn); B. H. Clarke (Whetstone, N.20); C. W. Harris (Yeovil); L. Laguerre (Sidmouth); H. MacRobert (East Kilbride, Lanark); K. Tennyson (Nottingham); W. Stewart (Lenzie); F. E. Wilde (Rhondda, Glam.).

Word Census.—As we suspected, the number of appearances of the word "Meccano" in the March *"M.M."* was truly enormous; the actual figure must remain a secret, of course, until the Overseas section closes. The surprising feature of the contest, however, was that out of the many hundreds who took part, only 24 boys succeeded in giving the correct figure!

It was necessary to take neatness and novelty of presentation into consideration in making the awards and H. C. Dumler, of Moss Side, Manchester, scored an easy victory with a picture of a cricketer hitting a copy of the *"M.M."* to all parts of a cricket ground, every scoring stroke being represented by the word "Meccano." Upon the score board appears the solution to the competition.

The subsidiary awards were as follows:—

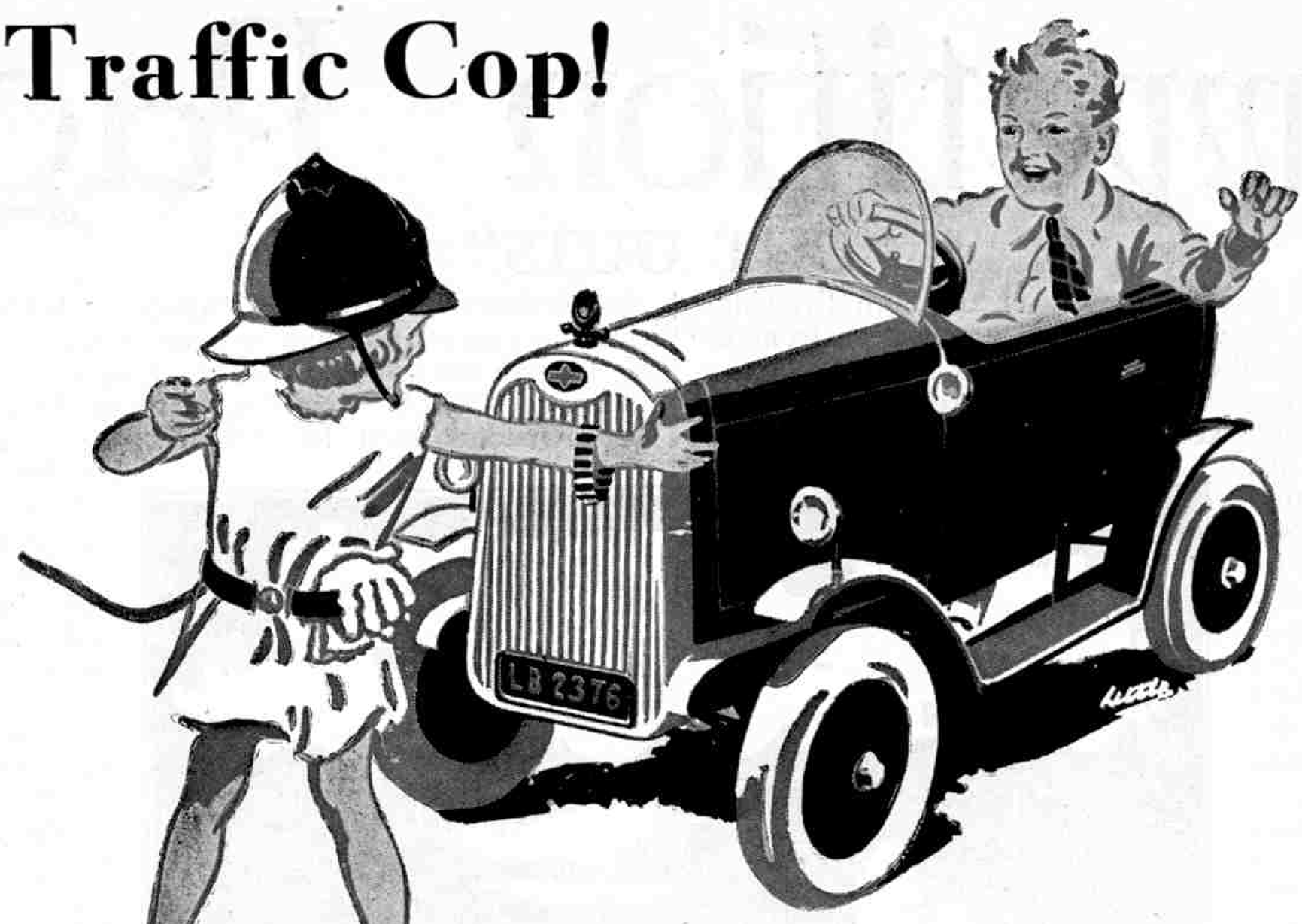
2. H. D. Burrough (Sherborne); 3. L. E. Copeland (Herne Hill, S.E.24); 4. F. Matson (Faversham).

Consolation prizes were awarded to the remaining 20 competitors who succeeded in giving the correct solution.

OVERSEAS

Expressions Contest.—First Prizes: Section A, T. L. Roberts (Auckland, N.Z.); Section B, J. A. Rodriguez (Montreal, P.Q.). Second Prizes: Section A, P. Blair (Toronto, Ont.); Section B, J. Credie (Cape Town, S.A.). Consolation Prizes: J. S. Christie (Seremban, F.M.S.); E. Grubb (Vancouver, B.C.).

Traffic Cop!



They don't know which is more fun – being bobby or driving the Tri-ang.

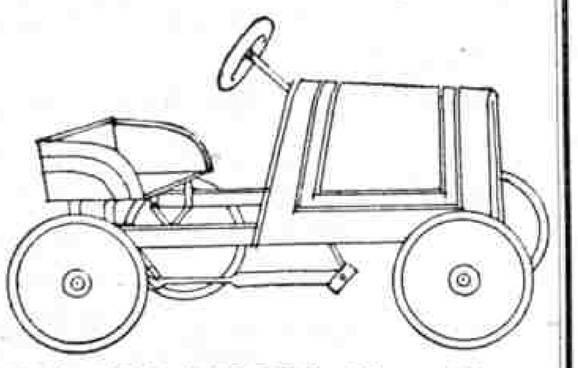
And the fun doesn't stop there.

There are real tool boxes containing real spanners. Spare petrol and oil cans are carried on the running-board. Some models have self-starter buttons on the dash which make a realistic noise when pressed! Licence-holders, horns, lamps, adjustable seats are fitted to even the very inexpensive models. And there is a fabric saloon, which has head-lamps that light and a bonnet that can be lifted up. Of course, the higher the price the more elaborate the equipment, but the 15/- model is just as much a Tri-ang Car as the fifteen-guinea one—in strength and value for money.

Ask to see Tri-ang Cars at any good toyshop or stores.

TRI-ANG
CHEVROLET DE LUXE NO. 4 29/6
(Illustrated above).

Scale model Chevrolet radiator. Easy running double crank drive, 9 in. steel disc balloon wheels. Rubber tyres and pedals. Accessories include 4 lamps and motometer. Side door opens.



TRI-ANG LIZZIE. No. 3 15/-
All-steel body. Easy running double crank drive. 8 in. rubber tyred wheels. 6 in. steering wheel. Lamp. Rubber pedals. Recommended for motorists from 2 to 5 years old.

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Ball-bearing double crank drive and back axle. Black stove enamelled radiator. 11 in. steel disc balloon wheels. Rubber tyres and pedals. Accessories include 4 lamps, windscreen, licence holder, motometer, starting handle, oil can and petrol tin. Side door opens.

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Fireside Fun

A WASTE OF TIME

Mother: "Now, Willie, suppose you were to hand Jimmy a plate with a large and a small piece of cake on it, would you tell him to take the larger piece?"
Willie: "No."
Mother: "Why not?'
Willie: "Because it wouldn't be necessary."

* * * *

"Did you hear that the fire department got rid of their efficiency expert?"
"No! Why?"
"He put unbreakable glass in all the fire alarm boxes."

* * * *

Husband: "Don't bring me any more bills. I can't face them."
Wife: "You needn't. I only want you to foot them."

* * * *

The man in the corner of the railway carriage had not spoken once throughout the journey.
"You're a bright sort of fellow," remarked one of the party. "It's easy to see that your people came from Scotland."
"No, sir, ye are badly mistaken," replied the silent one."
"What," said the other, "didn't they come from Scotland?"
"No, sir," was the reply. "They are there yit."

* * * *

A number of men were debating whether a playwright should or should not make a speech at the end of a first performance. There happened to be among the crowd one who had had a play produced.
"By the way," said somebody, "did you make a speech after your play?"
"Oh, yes," said the author.
"What did you say?"
"I said 'And boo to you, too.'"

* * * *

BOUND TO RISE

First Tramp: "How did you manage to climb so high up in that oak tree?"
Second Tramp: "Well, you see, I sat on it when it was an acorn."

* * * *

"Did you read about the man who swallowed his teaspoon?"
"No. How is he now?"
"He can't stir."

* * * *

"Are you sure these field-glasses are high-powered?" asked the customer.
"Madam," replied the salesman, "when you use these glasses anything less than ten miles away appears to be behind you."

* * * *

"How long have you been working for the firm?"
"Ever since the manager threatened to sack me."

AN INTERNATIONAL LUNCH

Waiter: "Are you Hungary?"
Diner: "Yes, Siam."
Waiter: "Den Russia to the table and I'll Fiji."
Diner: "All right, Sweden my coffee and Denmark my bill."

* * * *

Teacher: "Give me a long word."
Johnny: "Prophylactic."
Teacher: "Good. Another."
Johnny: "Rubber."
Teacher: "That's not long enough."
Johnny: "Well, teacher, you can stretch it.'

* * * *

WHERE AM I?

Punctuality was not old Sambo's strong point, but in view of his long service with the firm, his one great failing was usually overlooked. One morning he arrived more than an hour late, however. His master thought that the limit had been reached, and angrily demanded the reason.
"Well, sah," said Sambo, "Ah jumped out 'o' bed early dis morning as usual, an' when Ah looked in de mirror Ah couldn't see no Sambo; so Ah thought Ah must hab gone to work. An' do you know, sah, it wasn't until some time later dat Ah discovered dat de glass had fallen out ob de frame!"

* * * *

A Welshman was playing a golf match in which he was getting the worst of it. He was obviously chagrined and was gradually finding it more and more difficult to contain his annoyance. At last his opponent sliced his drive badly. This unexpected piece of luck was too much for him and he exclaimed excitedly, "Ah, I'm afraid you're in the bunker, I hope!"

* * * *

Boots: "Are you the gentleman who wanted to be wakened to catch the early train?"
Guest: "Yes."
Boots: "Then you can go to sleep again—you've missed it."

* * * *

The very slow local train pulled up in a stretch between two fields.
"What's the delay, guard?" asked the irate passenger who had an important engagement to keep.
"Nothing much, sir," said the guard. "A cow has strayed on to the line. We'll be moving again in a minute."
A mile or so further on the train came to another standstill. The same passenger's head was thrust out of the carriage window immediately.
"What's wrong this time?" he roared.
"It's quite all right, sir," the guard reassured him. "We've just caught that cow up again."

* * * *

Visitor: "Do you like reciting, dear?"
Child "Oh, no. I hate it really. But mummy only makes me do it when she wants people to go."

* * * *

The young wife rushed into her husband's office, mad with excitement.
"Oh, Henry," she cried, "Matilda made a mistake and tried to light the fire with petrol."
"Petrol, eh?" said her husband calmly. "Did she get it lit?"
"Get it lit?" shrieked the wife. "It blew her out of the window."
"Oh, well," remarked the philosophic husband, "it was her afternoon out, anyhow."

A DANGEROUS PRACTICE

"Were you pleased with the new school, little boy?" enquired an interested lady.
"No!" said Johnny. "They made me wash my face an' when I went home the dog bit me 'cause he didn't know me."

* * * *

Waiter (to diner): "Are you the filleted kipper?"
Diner: "No, I'm a poor lonely sole with an empty plaice waiting for something to fillet."

* * * *

Small girl (to grocer): "Half a pound of tenpenny margarine, please. And mother will send you sixpence this evening, and could I have the penny change now, as we want it for the gas meter."

* * * *

Jimmy: "Boo-hoo, I dreamed our school had closed down."
Mummy: "Never mind, it hasn't really."
Jimmy: "I know; that's why I'm crying."

* * * *

A motorist making his way North in a great hurry was not quite sure of his direction. As he came to one of the cross roads, he espied one of the local lassies and pulled up to inquire.
"Motherwell?" he called out interrogatively.
"Fine, sir!" said the lassie, beaming. "How's your own?"

* * * *

"This paper hasn't the usual water mark," said the customer at the stationer's.
"Quite correct, sir," agreed the obliging shopman. "That is on account of the recent drought, you know sir."

* * * *

Salesman (showing customer some sports stockings): "Just the thing for you. Worth double the money. Latest pattern, fast colours, holeproof, won't shrink, and it's a very good yarn."
Customer (moving off): "Very well told, too."

* * * *

Pat went to the chemist's shop to get an empty bottle. Selecting one that was the size he wanted, he asked the price.
"Well," said the assistant, "if you want the empty bottle it'll be threepence, but if you want something put in it we don't charge anything for the bottle."
"Sure, that's fair enough," observed Pat, "put in a cork!"

* * * *

CORRECTLY DIAGNOSED

Uncle (feeling Tommy's head): "Yes, my boy, I think this bump must be a bump of inquisitiveness."
Tommy: "It is! I was looking into Percy Smith's desk, and the lid fell down."

* * * *

Policeman: "No fishing allowed here."
Man with Line: "I'm not fishing. I'm allowing this worm to bathe."
Policeman: "Let me see the worm."
Man: "Here it is."
Policeman: "I arrest you for allowing it to bathe without wearing a regulation swimming costume!"

* * * *

The owner of a popular brand of car was having trouble in starting his engine.
After watching the man wrestling with the starting crank for ten minutes, a little boy said to his father: "How far will it go on one winding, father?"

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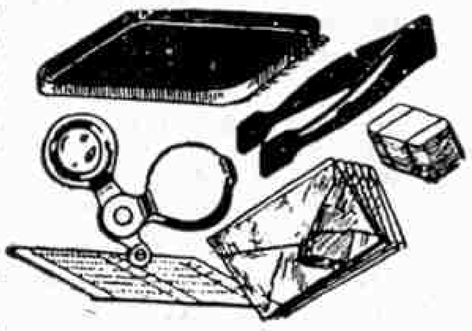

GENERAL v. SPECIALISED COLLECTING

A YOUNG reader of the *"M.M."* has written to us in great trouble. For some years, he tells us, he has collected stamps in a more or less haphazard way and has thoroughly enjoyed himself. Now his chum has joined a philatelic club, has become afflicted with the "disease of specialism" and has declared that our correspondent's general collecting is a waste of time and money! Quite naturally, our reader is troubled, and wishes to know whether he has really gone so badly astray, and he adds quite bluntly: "I would rather give up stamp collecting altogether than spend my evenings peeping at minor varieties through a microscope!"

The problem of general versus specialised collecting is not new. It has existed ever since stamp collecting, or, for that matter, any form of collecting, became popular, and a few words of advice may help to dispel the doubts of many readers, in addition to the correspondent who has raised the question.

We cannot do better than quote some extracts from a talk given to the members of the Birmingham Philatelic Society some two years ago by Mr. G. Herbert Dannatt, the eminent specialist collector.

Mr. Dannatt said: "The true object of collecting anything is the pursuit of happiness, and if true happiness, like all other truth, lies in the direction of simplicity, why on earth should any collector be bludgeoned along the uneasy pathway of specialism if he would very much prefer to leave it severely alone . . . . . " " . . . . . the 'generalist' is fully entitled to collect any 'variety,' however trivial, if it appeals to him . . . . . " "The only thing that matters is to collect just what you like and encourage others to do the same . . . . . "

The final extract sums the situation up admirably. The general collector and the specialist have their respective places in philately. Each contributes something to the general welfare and each should tolerate, if he cannot agree with, the other.

The same correspondent asks for advice in the mounting of flown and other complete covers. He points out the difficulty of the variations in size and asks how it can be got over.

The only solution, of course, is an album of sufficiently large size to accommodate all but freak envelopes. It may be necessary even then to place some covers the long way of the page. Doubtless our correspondent is more concerned with the problem of fixing the covers to the pages of the album. Adaptability must be the order of the day. Small, light covers can be fixed with ordinary stamp mounts, provided sufficient of them are used. With heavier covers stamp edging or adhesive paper tape is satisfactory. It is assumed, of course, that the back of the cover is of no importance.

Other collectors we know use adhesive paper tape cut to form tapes across the corners of the covers. The covers are slipped through in the same way that cigarette cards are slipped into their albums. We have seen strips of wide adhesive paper gummed across the album pages to form transparent pockets for the covers. This system is similar to that employed in stamp collectors' duplicate books, and it is a very simple matter to slip the covers out if a close inspection is to be made. A very important point to be observed is that the pages of the album must be of stout paper; a light card is best of all. The trouble with thin paper pages is that they cockle and bend badly under the weight of the cover when they are being turned over.

Our correspondent specifically asked for advice in regard to mounting in an album, but he, and other readers, may be interested to know that we use a card index style of box for the purpose. Stout transparent paper is gummed to light card to form envelopes into which the covers are inserted. Space is provided on the back of the filing card for the registration of the details of the enclosed cover, and each cover is allotted a number, which is placed on the card.

The covers are filed under countries, but as the majority of them have some special interest apart from the country of origin, a special cross-referenced index of classified subjects is maintained in a small notebook kept in the back of the filing box. This system does not allow quite the same easy examination that is possible with an album, but it is vastly less expensive and solves the problems of varying sizes and easy retention of position.

Our correspondent raises a third most interesting point. He states that he has read somewhere that a standard test for chalk surfaced stamps is to rub them lightly with the edge of a silver coin, when a black pencil-like mark will appear. After trying the idea out unsuccessfully with several mint stamps on paper known to be chalk surfaced, our reader suspects "there's a snag somewhere." Quite right, there is! But not in the idea.

The lack of response to the test almost certainly is due to the use of an up-to-date coin, containing only a very modest proportion of silver. If our reader will secure a pre-war sixpence, preferably well worn, he will find no further difficulty. The edge of the coin should be clean when used in the test; otherwise the coin will leave a dirty mark, suggesting that every stamp tested is on "chalky." It is important to rub the stamp only very lightly, otherwise it will be defaced by a heavy unsightly black mark.

In concluding this short chat, we should like to make it clear that the object of our stamp articles is to help young collectors to secure the utmost enjoyment from their hobby. In any matter of doubt we shall be glad to be of assistance.

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Building with Steel—*(Continued from page 355)*

placed in position, and the outer end lengths of the permanent cross girders attached to them and to the temporary bridge. The flooring of the cantilever footpaths was completed and pedestrian traffic was transferred to them.

The tramways were transferred from the old bridge to the space between the temporary bridge and the new ribs where the permanent flooring had been laid down, and a temporary track provided for the trams. To remove the old bridge superstructure a gantry for an overhead electric crane was fixed inside the temporary bridge. When installed, this crane handled all the old materials and erected the central portion of the permanent cross girders and the new floor. When this floor was completed the tramways were transferred to their new position in the centre of the new bridge, and the temporary bridge was removed.

For the details of the construction of the Wearmouth Bridge we are indebted to a paper by Mr. Adam Hunter, M.Inst.C.E., M.Am.Soc.C.E., M.I.Struct.E., read before the Institution of Structural Engineers.

MAKE your own GRAMOPHONE at a ¼ the price. Buy only Mechanical Set as shown, namely: British double spring motor, 12" velvet turntable. "S" neck tonearm, latest metal Soundbox, shaped internal horn, or cast throat, and needle cups for **£1/18/6**, post free in U.K. Machines sold by other firms at **£10-£20**, do not contain better fittings than these. Tubular No. 815. horn 17/- post paid. We also sell cabinets for this 2-wing set. Portable Gramophones from **19/6.** Postage **1/6.** Mechanical Sets **18/-.** Motors, **8/6.** Accessories, Accordeons, Violins. Lists Free. 64 pp. 1930 Catalogue, **How to make Gramophones, 3d.** Established 25 years. Thousands of Testimonials. **Regent Fittings Co., 78D, 120, Old St., London, E.C.1**

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Cowboys, Indians, Animals, Zulus, Model Farmyard Sets, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for Illustrated Catalogue. Complete mould ready for work **2/6.**—**"TOYMOULDS," 67, Stafford Street, Birmingham.**

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L. B. W.!

Don't put your leg before the wicket—hold a good Bat there instead!

BUY A GENUINE

"WILFRED RHODES"

Autograph Cricket Bat

PRICE only **15/-** **Post Free.**

Each one specially selected.

Rubber Grip 1/- extra.

Please state if size 4, 5, 6 is required.

Get yours now from

JEPSON'S SPORTS DEPOT
Broad Gate, Coventry

Stamp Gossip

Air Mail Notes

The flood of new air mail issues shows little sign of abating and at the present time the air stamp field is almost more prolific in its productivity than the general branches of our hobby. The most interesting issue of recent days is from Papua, where the 3d. blue green and black stamp of the 1916 series has been overprinted "Air Mail" for use on mail matter carried on the new Port Moresby-Samurai service.

The rapid development of aviation in South and Central America is clearly to be traced by the activity of air stamp issues among the countries constituting those territories. Many of them already have "definitive" issues, and the remainder are at present using or issuing provisionals.

Salvador has recently completed the issue of a provisional overprinted air stamp issue and arrangements will shortly be put in hand with a view to substituting a permanent issue.

A permanent air stamp series is to make its appearance in Honduras shortly, to displace the provisionals that have been in use so long. Four denominations are to come, five and 20 centavos, one and five pesos.

Paraguay is now changing over from the provisional issues, the first stamps of the permanent set, 95c. and 1p.90, appearing

a month or two ago. They are large square stamps, the lower value bearing the national arms, surmounted by an aeroplane, within a circle inscribed "Correo Aero." The higher value shows a monoplane flying over the Cathedral of Asuncion. For an unexplained reason both values appear in two varieties of colour, the 95c. taking deep blue on blue, and scarlet on pink, and the 1p.90, violet on blue and rose on pink. Twelve other values are to follow.

We are indebted to Mr. K. E. Haines, Punxsutawney, Pa., for the specimen from which the new U.S.A. 5c. issue is illustrated on this page. In format it is exactly as the 1926/27 issues, but, for the first time for a U.S. air stamp, the design is symbolical.

Nicaragua issued a short set in December last, 25c., 50c., and 1 cor. All the stamps use the design that is illustrated on this page, showing biplanes passing over the summit of Mount Momotombo. Hayti also has added two values to its series, the first of which appeared in November, 1929, the most recent being the 1 gourde, illustrated.

The Air Mails of Iceland

The issue of a definitive air stamp for Iceland focusses attention on an air mail service that is almost unique among the smaller countries of the Northern Hemisphere, for Iceland's service has no connection, direct or indirect, with any other country.

If one considers only size and population, the scope for aerial services in Iceland is extremely limited. Iceland is considerably greater than Ireland, but its population is less than 100,000. Nevertheless, the service has been a distinct success right from its inception. The fact that all the important centres of population are situated on the coast line probably accounts for the use of a seaplane in maintaining the air service.

The service was inaugurated in June, 1928, with a Junkers F.13 machine, the inaugural flight being made between Reykjavik and Akureyri. Before the end of September, when the service closed down for the year, rather more than 16,000 miles had been flown, although in June a fortnight's suspension, due to engine trouble, had been found necessary.

For this service a special air mail stamp was provided by overprinting the current 10 aur stamps with a device representing the Junkers machine that carried the mail. A special label bearing the inscription "Par Avion Loftbios" was also provided, its outstanding feature being its exceptionally small size.

The service was re-opened on 3rd July, 1929, and remained in steady operation until 20th September, the mileage for the season being 34,800. During the season a further air mail provisional appeared; on this occasion the 1928 overprinting device was applied to the 50 aur value of the 1907 issue.

The inhabitants of the island have found the air mail service a real boon and have given it their whole-hearted support, a fact that has led to the introduction of a special 10 aur air mail stamp, illustrated here, in readiness for the 1930 season. Coloured blue, this stamp is triangular in format. Its design shows an Icelandic falcon disdainfully watching the passage of a mail 'plane.—"Stanley Gibbons Monthly."

An Appreciation

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with our Stamp article and the Stamp Gossip have been prepared.

Beyrouth Silk Congress

Industry of many kinds has been featured in stamp designs, but nothing quite so novel as the Grand Lebanon Silk Congress commemorative has been issued previously. As our illustration shows, the design includes a portion of a branch and leaves of a mulberry tree, with a silkworm feeding, a cocoon and a moth.

Strangely enough stamp collecting owes this design to chance. Originally it was the intention of the Lebanese authorities merely to overprint the existing issue. Wiser counsel prevailed and a local firm was entrusted with the production of a new design, with the happy result indicated.

There are six stamps in the series, ranging from 4 to 25 piastres, and the same design is used for each. The perforation is 11.

Bahamas Tercentenary

At first sight the casual observer, overlooking the name tablet, would be inclined to attribute the recent, but very belated, Bahamas issue to the Cyprus Jubilee issue of 1928, for the presentation and the production of the two issues is strikingly similar. Possibly this is due to the fact that Messrs. Bradbury, Wilkinson & Company were responsible for both productions.

The issue is in commemoration of the third centenary of the occupation of the Island by British forces in 1629. It was

not until 100 years later that the Bahamas were adopted as a Crown Colony, and in effect, if not intention, the stamp is the centennial commemorative for the two events.

A Thousand Years of Parliament

Iceland is well in the stamp collecting picture this month. In addition to the air stamp referred to elsewhere, there has appeared a long set commemorating the millenary of the *Althing*, the Icelandic equivalent to our Houses of Parliament.

There are 15 values in the set, which also has appeared overprinted for official use. The designs principally feature legendary incidents in Scandinavian history, but a number of the stamps show scenic views, and the lowest value, 3 aur, shows a picture of the modern parliament buildings. Our illustration shows an old Viking ship, presumably in "a deep depression centred over Iceland."

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines and are beautifully enamelled, mostly in the correct colours of the L.N.E., L.M.S., G.W. or Southern Railways.

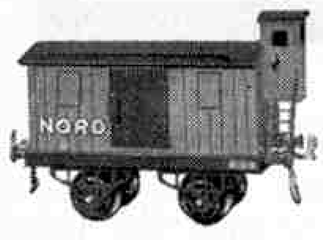
Ask your dealer to show you the full range of Hornby Rolling Stock.

PETROL TANK WAGON "PRATTS"
Finished in green.
Price **2/6**

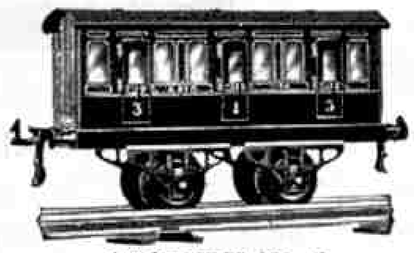
MOTOR SPIRIT TANK WAGON "B.P."
Finished in yellow.
Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red.
Price **2/6**

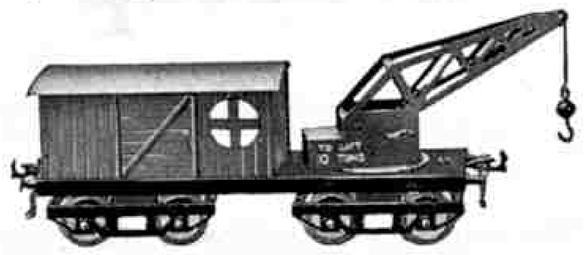
PETROL TANK WAGON "REDLINE"
Finished in blue and red.
Price **2/6**



BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/–**



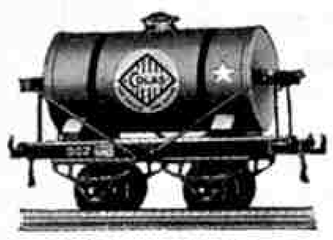
***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**



***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

GUARD'S VAN
Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours.
Price **3/–**

WAGON (French Type)
Lettered "Nord."
Highly finished in colours. Price **3/3**



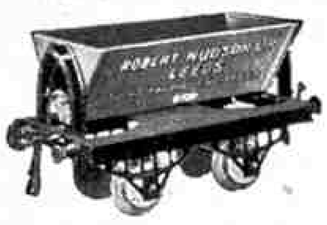
BITUMEN TANK WAGON "COLAS"
Finished in blue.
Price **5/3**

ROTARY TIPPING WAGON
Finished in orange. Lettered "Meccano." Price **3/–**

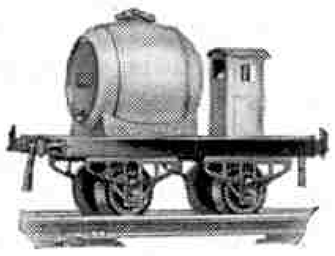
RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only.
Price **14/–**

GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

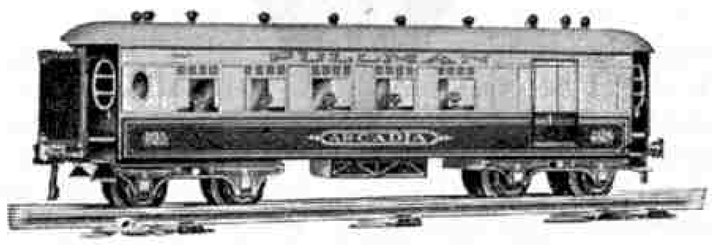
MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/–**



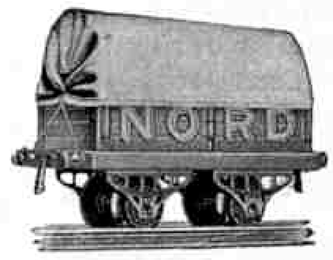
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



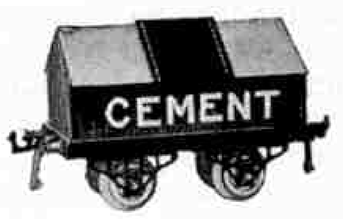
WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green.
Price **4/–**



†HORNBY No. 2 SPECIAL PULLMAN COACH COMPOSITE
As supplied with No. 2 Special and No. 3 Pullman Train Sets. One part is designed for passenger accommodation and the other for conveyance of luggage. Suitable for 2-ft. radius rails only.
Price **16/–**

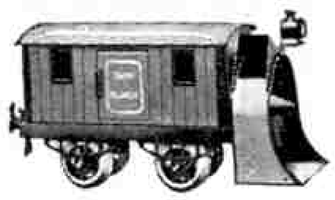


COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/–**

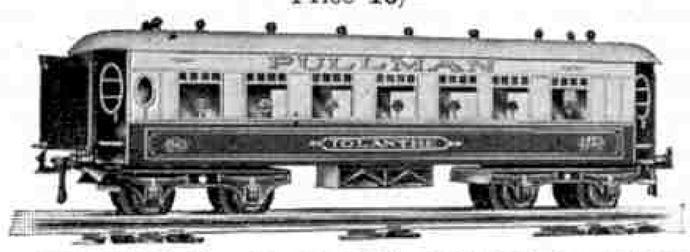


CEMENT WAGON
Finished in red.
Price **3/–**

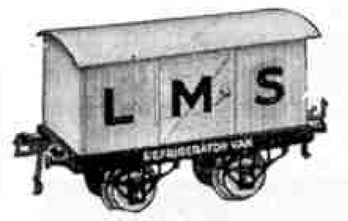
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



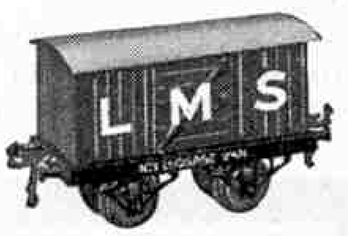
SNOW PLOUGH
With revolving plough driven from front axle.
Price **5/6**



†HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/–**

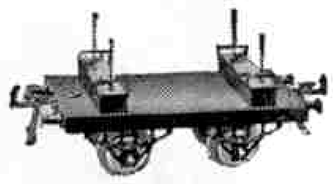


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors.
Price **3/9**



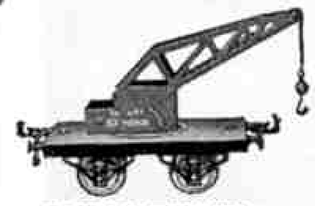
***LUGGAGE VAN No. 1**
With opening doors.
Price **3/6**

***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/6**

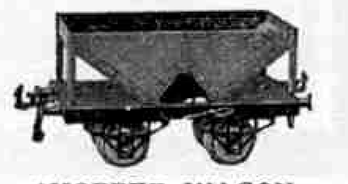


LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/–**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

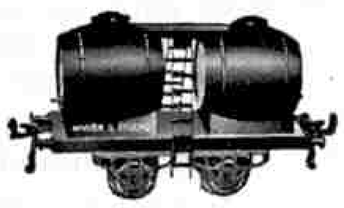


CRANE TRUCK
Finished in brown and blue. Price **3/6**

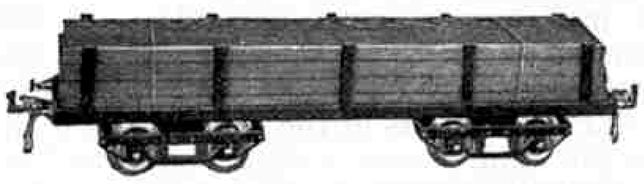


***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

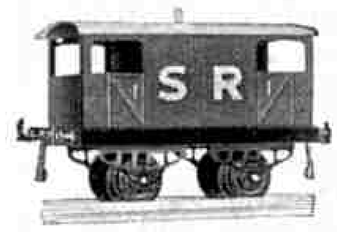
MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans.
Price **3/6**



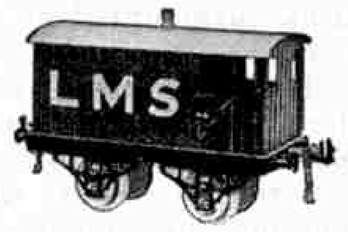
WINE WAGON, DOUBLE BARREL
An attractive model, artistically enamelled in red and green. Price **5/–**



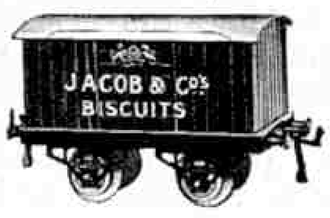
TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



BRAKE VAN
Finished in brown. With opening doors. Obtainable in N.E. or S.R. lettering. Price **3/6**

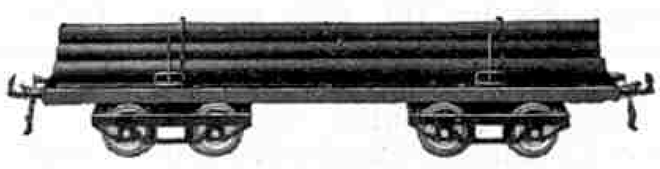


BRAKE VAN
Finished in Grey. Opening doors. Obtainable with L.M.S. or G.W. lettering. Price **3/6**



JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors.
Price **3/6**

CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**



LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only.
Price **4/–**

**In L.M.S., L.N.E.R., G.W., or S.R. lettering.*
†Previously known as No. 2/3 Pullman Coaches.

CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

SECCOTINE VAN
Beautifully finished in blue. With opening doors.
Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

HORNBY SERIES

HORNBY ACCESSORIES

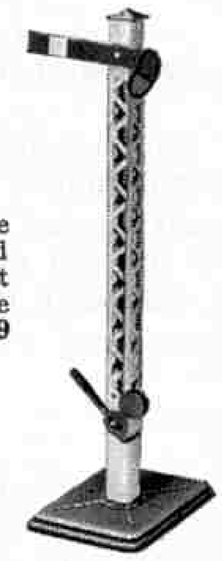
HORNBY SERIES

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

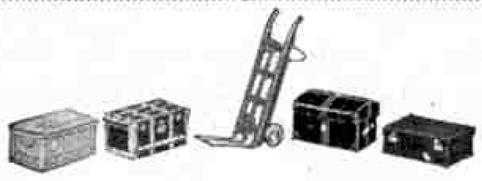
A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

LOADING GAUGE
Price 2/3

PLATFORM CRANE
This is a useful accessory. The Crane revolves on its base and is fitted with a crank and ratchet mechanism for controlling the load. Price **4/9**



SIGNAL No. 1
Price **3/3** per pair. One "Home" and one "Distant."

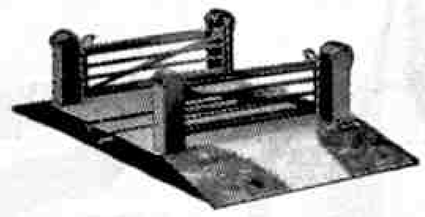


RAILWAY ACCESSORIES No. 1
Miniature Luggage and Truck.
Price per set **1/6**

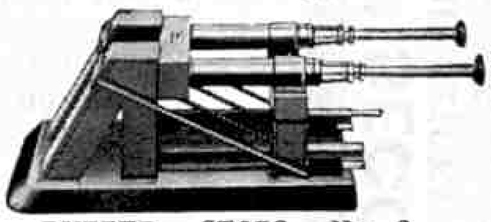
RAILWAY ACCESSORIES No. 3
Platform Machines, etc.
Price, per set **1/6**

RAILWAY ACCESSORIES No. 2
Milk Cans and Truck.
Price, per set **1/6**

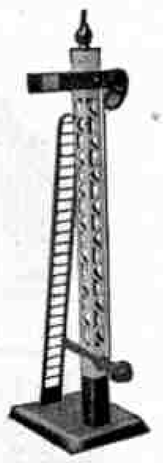
TELEGRAPH POLES
Price, per pair **4/-**



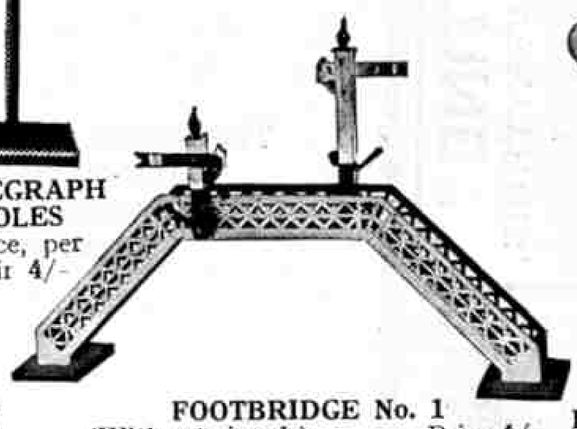
LEVEL CROSSING No. 1
This model is realistic in appearance and beautifully enamelled in colours. It is suitable for a single track only and has gauge 0 rails in position.
Price **3/6**



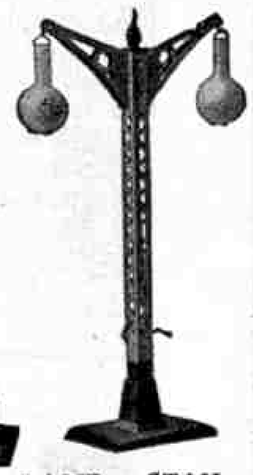
BUFFER STOPS No. 2 (HYDRAULIC)
Price **5/6**



SIGNAL No. 2
Price **2/6** each.
"Home" or "Distant."

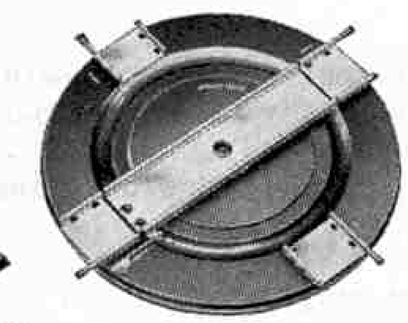


FOOTBRIDGE No. 1
(Without signals) ... Price **4/-**
FOOTBRIDGE No. 2
(As illustrated), complete with detachable signals. Price **7/6**
Signals only, per pair **3/9**



LAMP STANDARD No. 2 (DOUBLE)
Electric flash-lamp bulbs may be fitted into the globes.
Price **4/6**

DOUBLE ARM SIGNAL No. 1
Price **4/3** per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated.)
Price **3/-** each.



TURNTABLE No. 1.
Price **2/9**

RAILWAY ACCESSORIES No. 4. This set comprises all the pieces that are contained in Railway Accessories Nos. 1, 2 and 3 ... ... Price **3/9**

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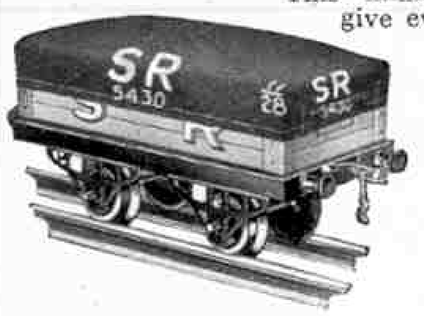

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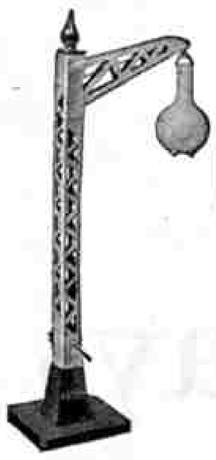
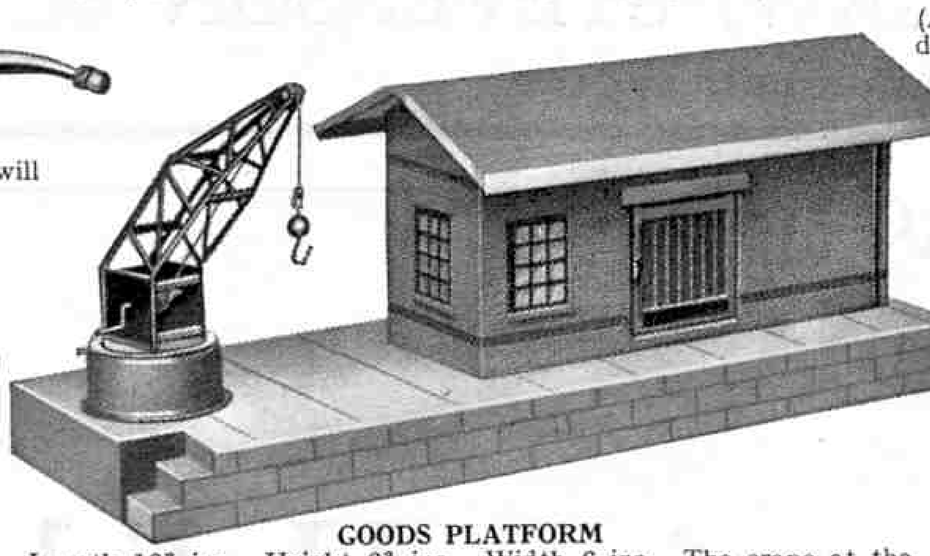
Strongly made. Lettered L.M.S., N.E., G.W. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon.
Price **3d.**



LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price **3/6**



GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price **12/6**

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"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height.
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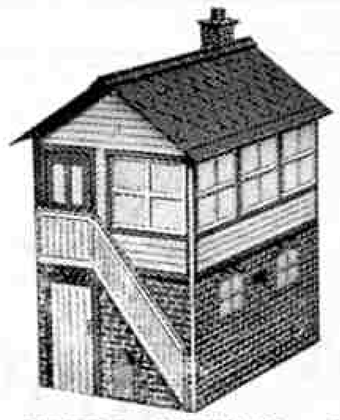
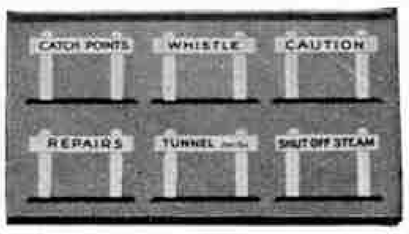
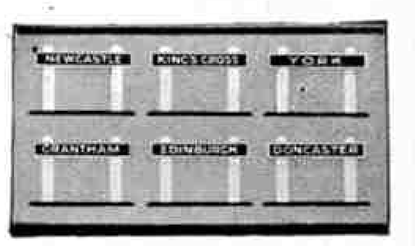


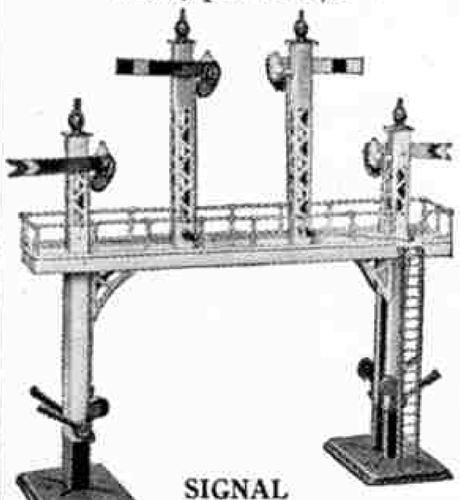
SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price **2/9**



RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set **2/3**

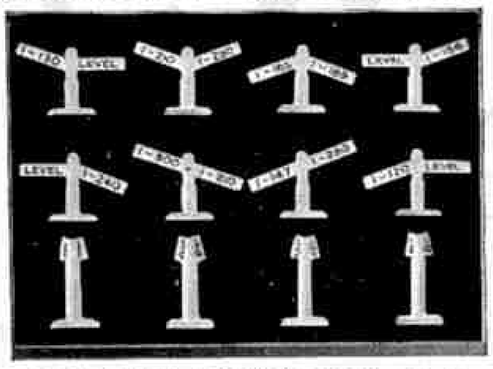


RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set **2/6**



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price **10/-**

RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price **1/6**



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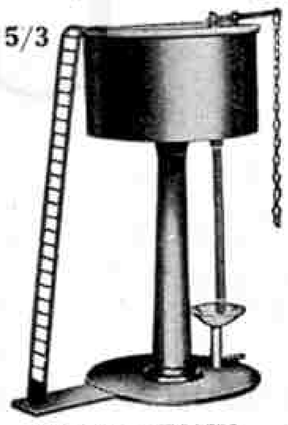

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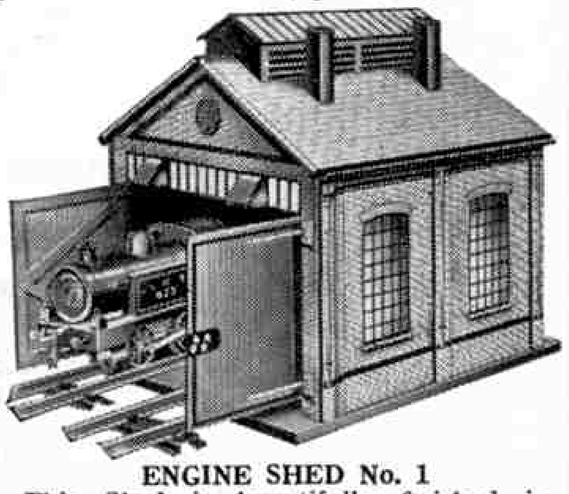
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price **12/6**



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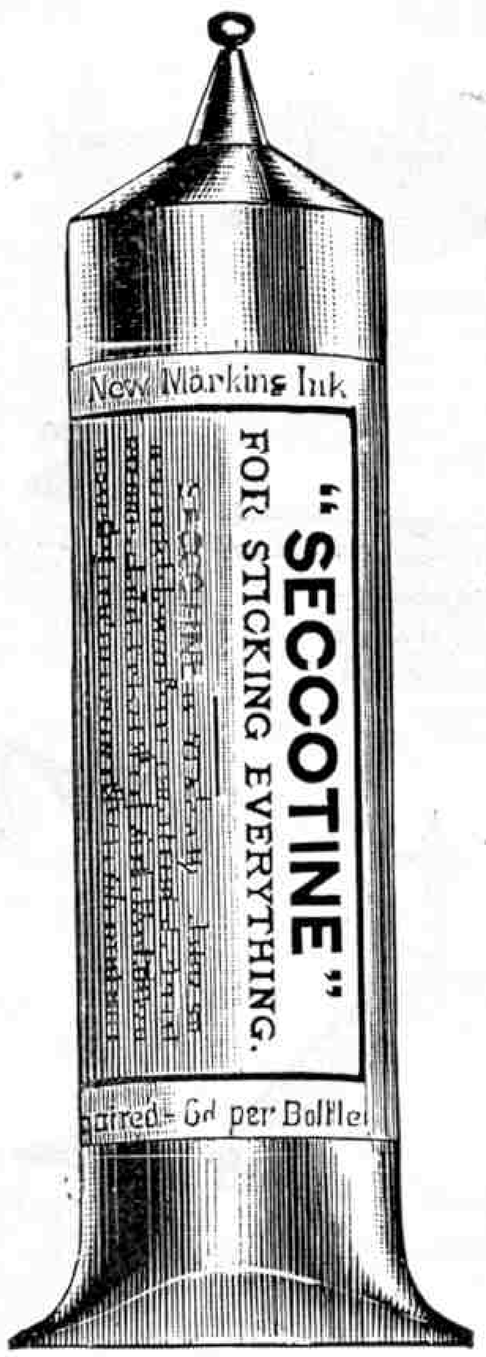

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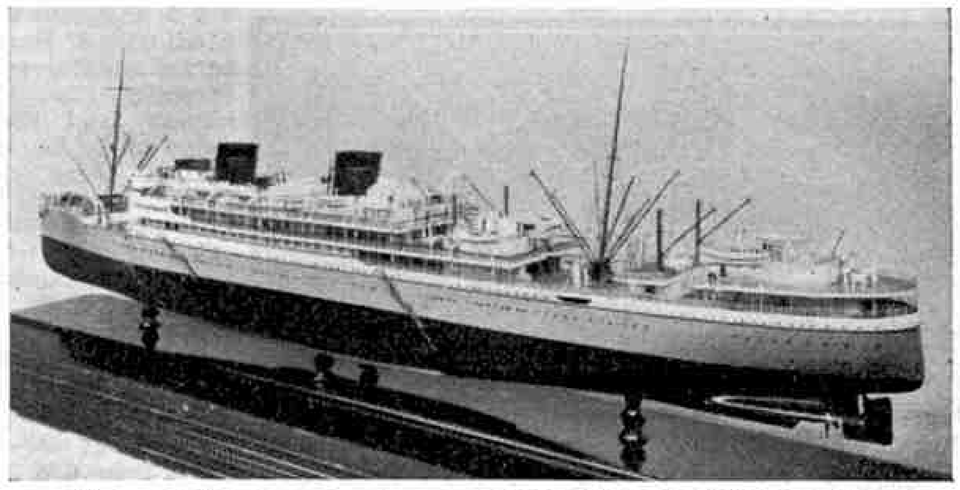

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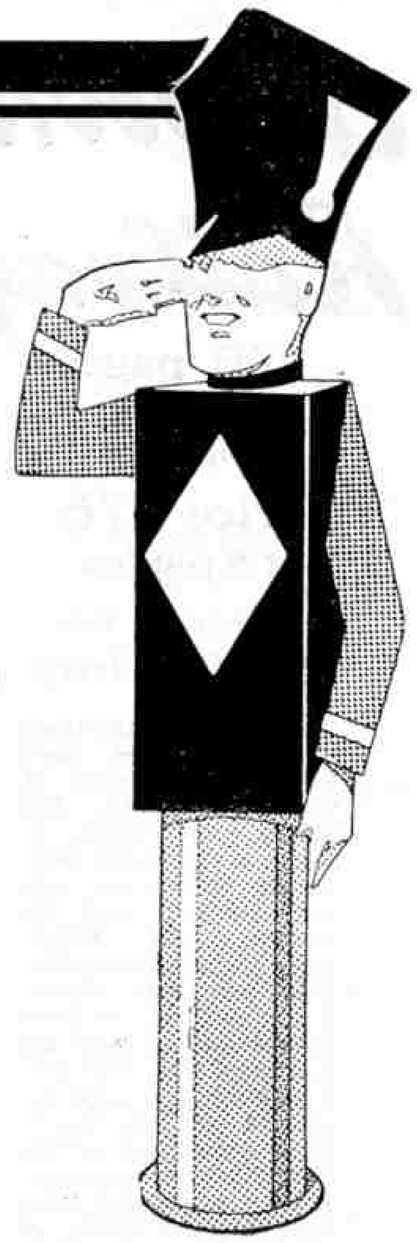

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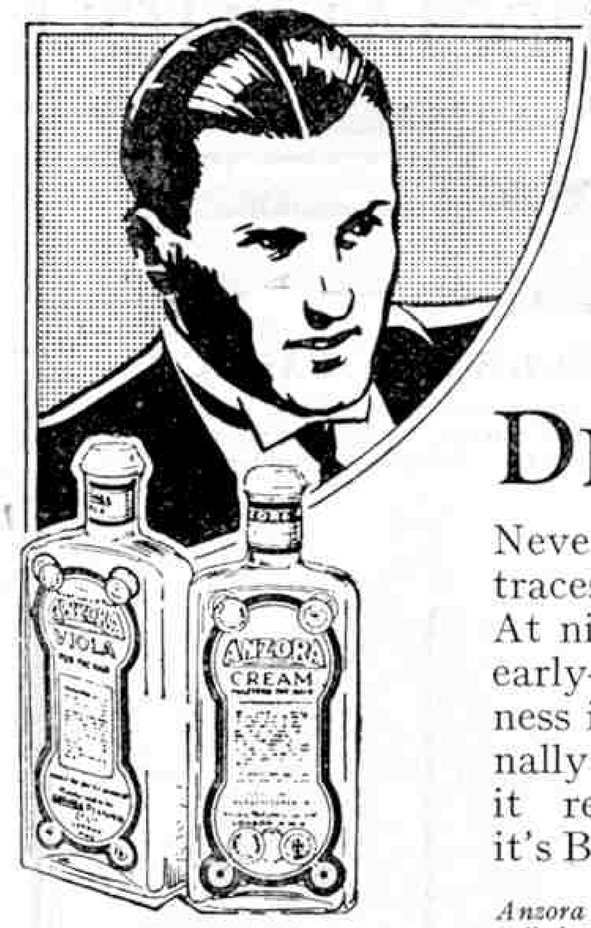

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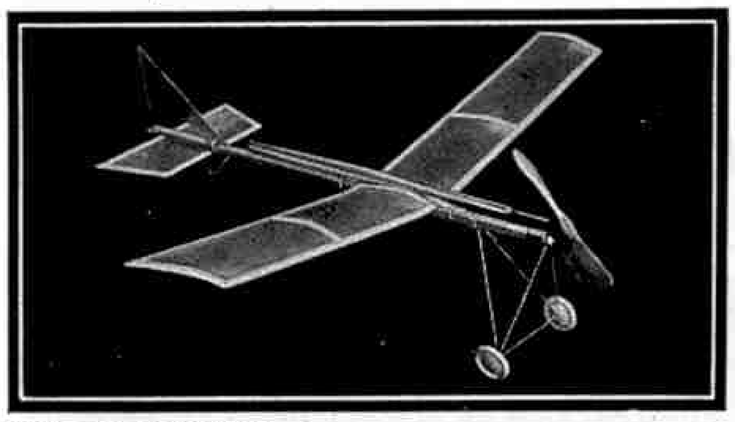

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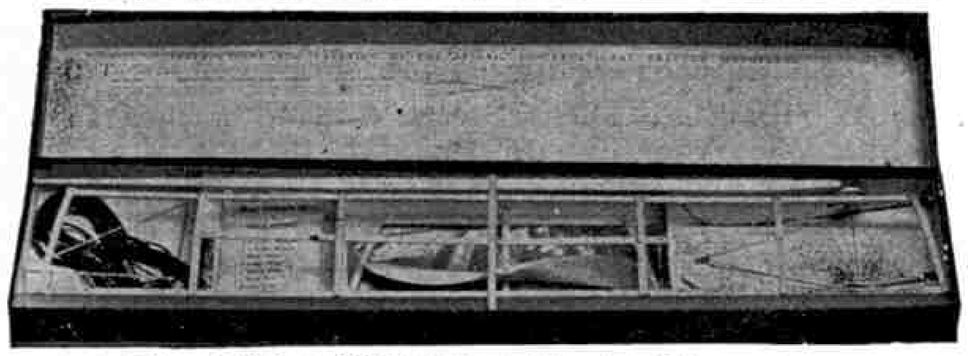

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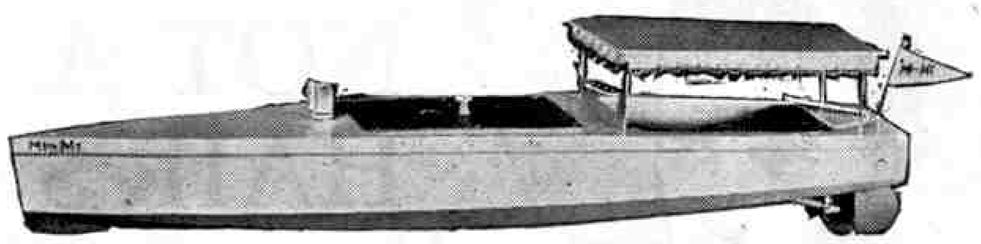

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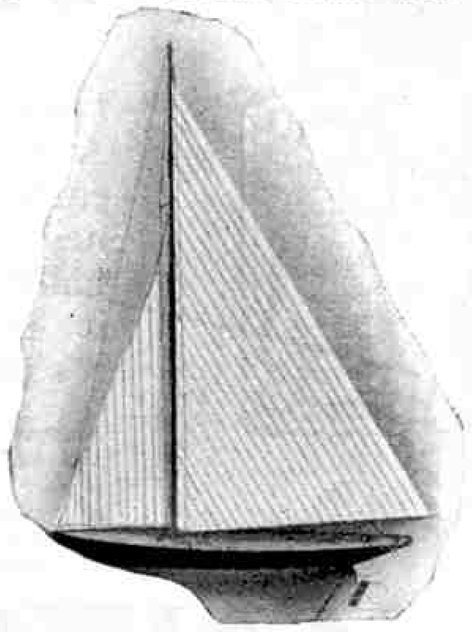

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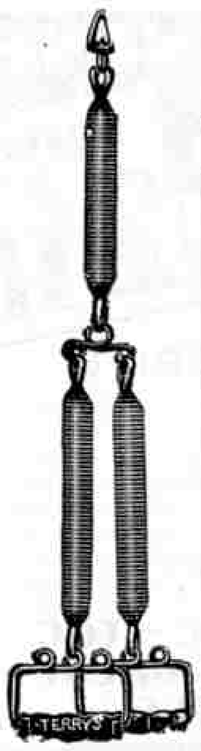

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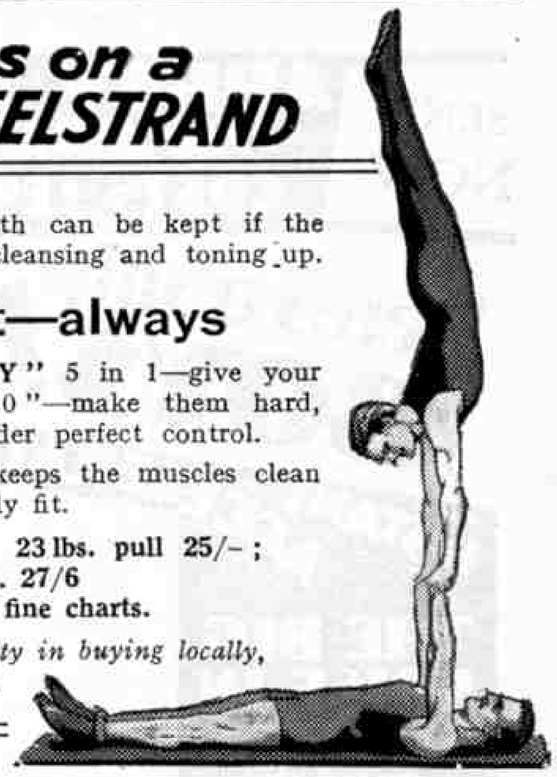

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Bronzed, **4d.** each.
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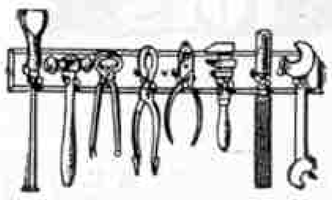

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4	6	8	10	12 clips
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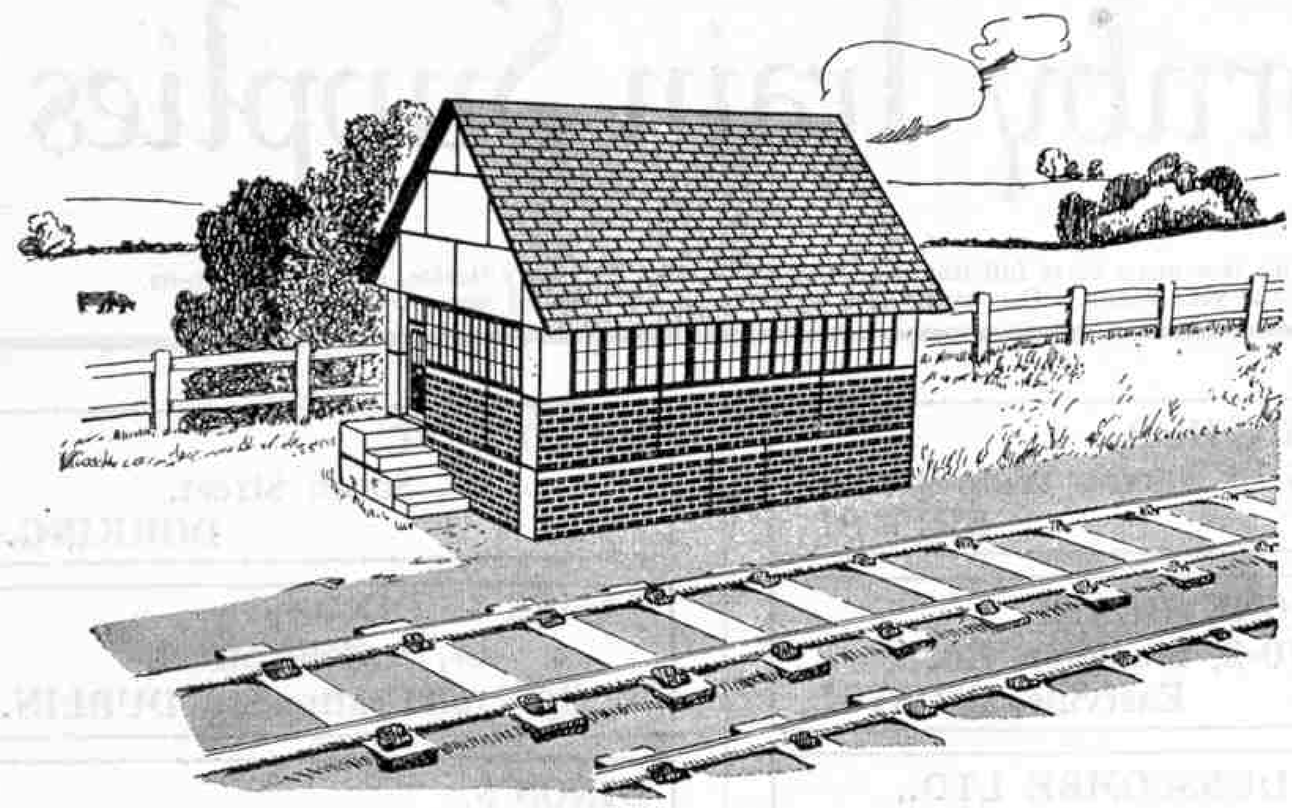

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Each Box is complete with Bricks, Roofs, and Plans in Colours for the number of models stated.

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It makes a splendid outfit for the real boy.

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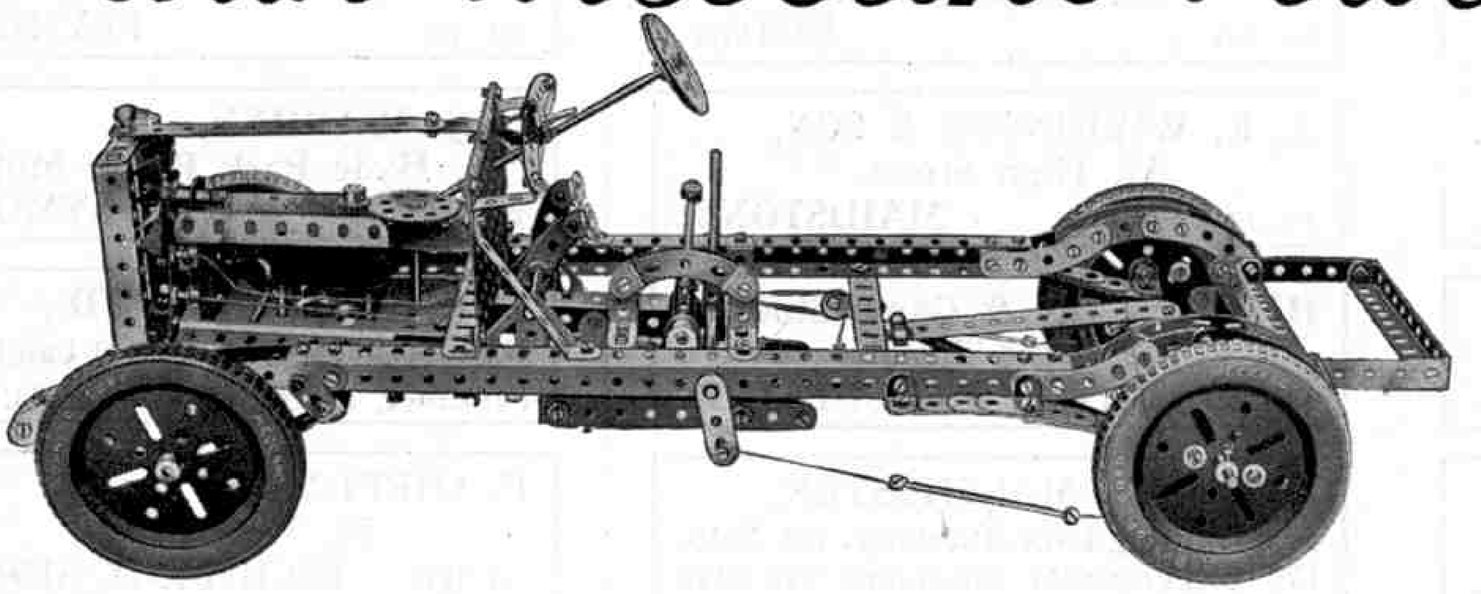
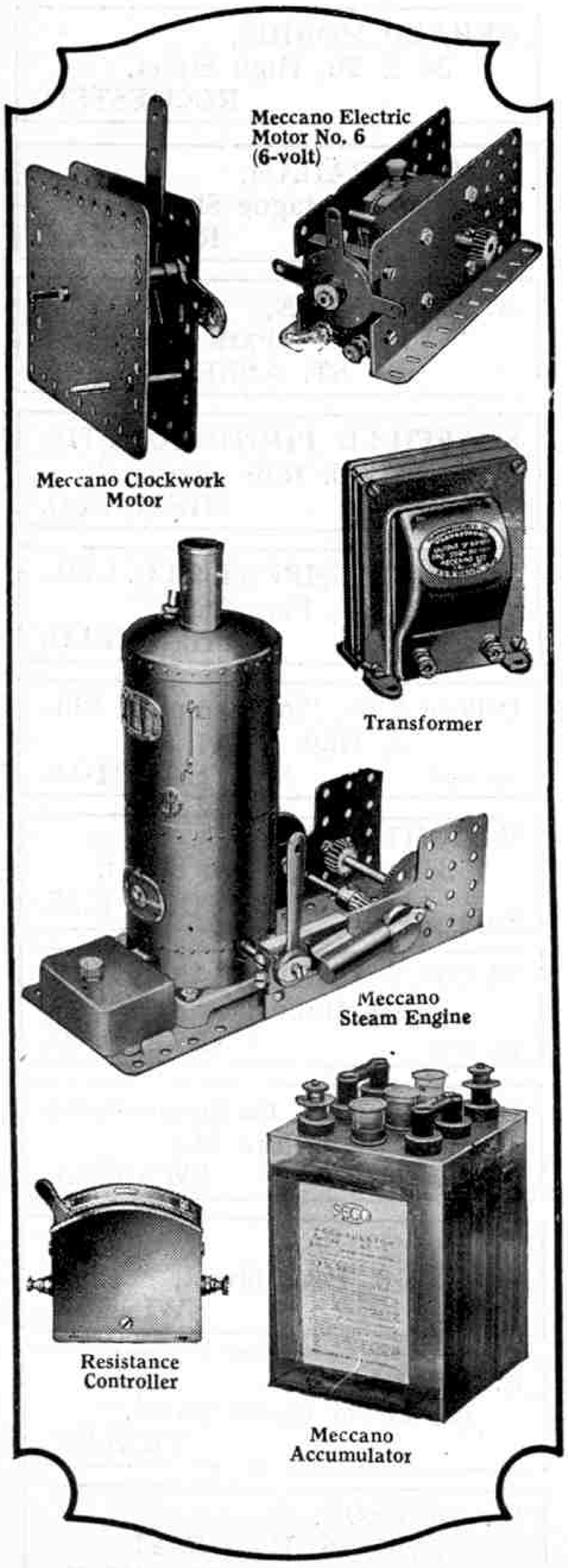


If you want to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor or Steam Engine. You push over the control lever of the motor or engine and immediately your Crane, Motor Car, Ship Coaler or Windmill commences to work in exactly the same manner as its "big brother" in real life. Could anything be more exciting?

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and Accessories are given below.



Meccano Clockwork Motor

This splendid Motor, which is specially designed for operating Meccano models, is a compact self-contained power unit.

An efficient governor controls the spring that is fitted on the motor and ensures a long steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed as required. Supplied complete with winding key and full instructions. Price **7/6**

Meccano Steam Engine

This is a particularly powerful steam unit designed for driving Meccano models. When suitably geared it is capable of developing remarkable power, sufficient to drive any of the models shown in the Manuals. On actual test it has lifted over 56 lbs. The base and side plates of the engine are drilled with standard Meccano equidistant holes, so that the engine may be built into any model. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft to run in either direction. This is a feature found only on expensive model steam engines. The crankshaft is fitted with a special compensated flywheel, thus ensuring steady running at all speeds.

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The 6-volt Motor is specially designed to build into Meccano models. It may be run from a 6-volt accumulator or, by employing the Transformer described below, from the main. It is fitted with reversing motion and provided with stopping and starting controls. The gearing is interchangeable. Price **15/6**

IMPORTANT.—This Motor will not run satisfactorily from dry cells.

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The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano Electric Motor No. 6. Price **28/6**

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By means of this transformer the Meccano Electric Motor No. 6 (6-volt) may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Complete with length of flex and adapter for connection to an ordinary lamp socket. Price **30/-**

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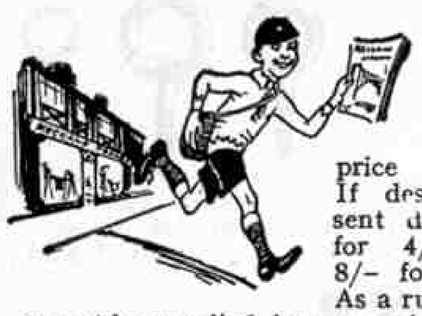

The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 'd. per copy. If desired it will be sent direct, post free, for 4/- for six, or 8/- for twelve issues. As a rule back numbers cannot be supplied, because only sufficient copies are printed to fill standing orders. To prevent disappointment, therefore, place a regular order with your dealer, newsagent or the publishers—

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All "Meccano Magazines" prior to December, 1923, are out of print. Each of the 1924 issues, with the exception of January, February and September is in stock. Only the June, July, October and November, 1925, issues are available. All the 1926, 1927, 1928, and 1929 issues are in stock, with the exception of January, February, April and May, 1926, and March, July and August, 1927, January and February, 1928.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927, 1928 and 1929 are 8d. each.

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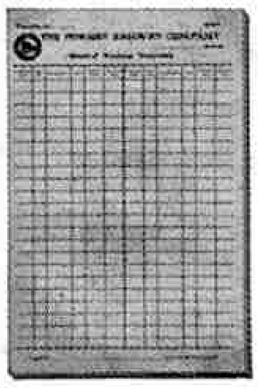

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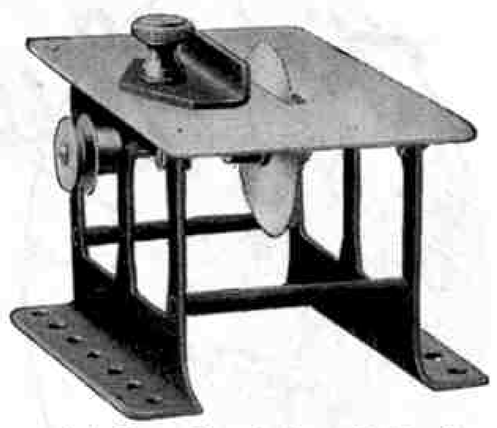

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Binding 6 or 12 copies. These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

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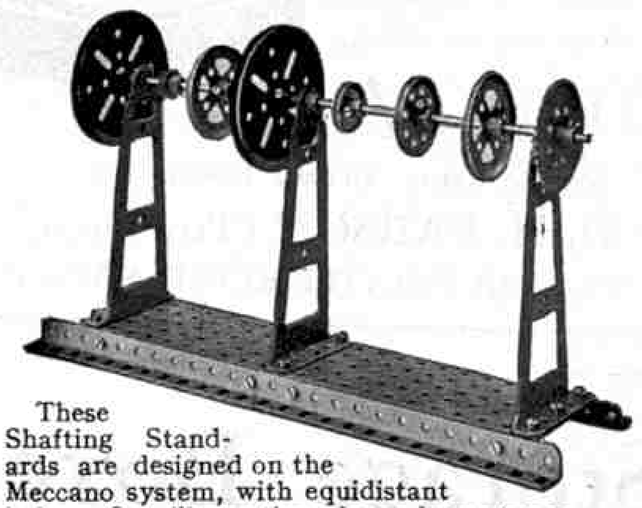

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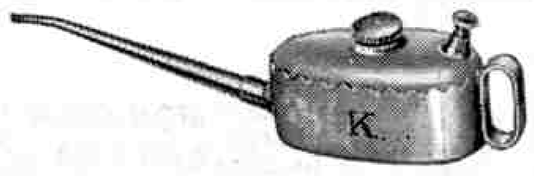

Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect.

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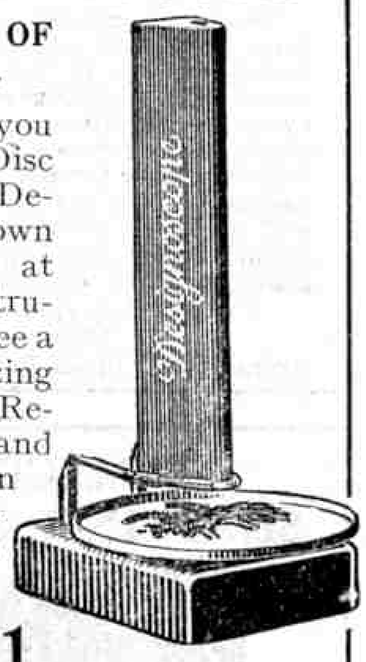

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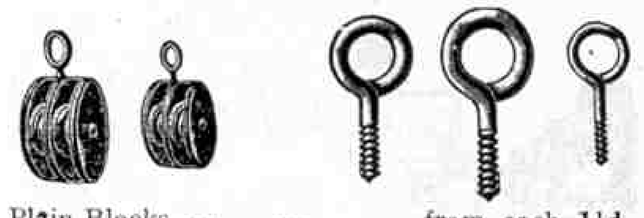

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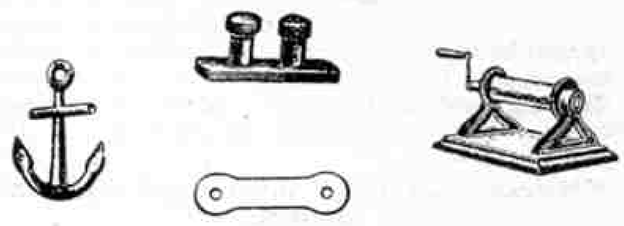

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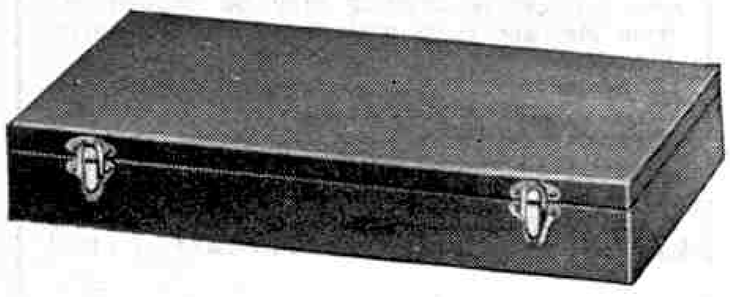

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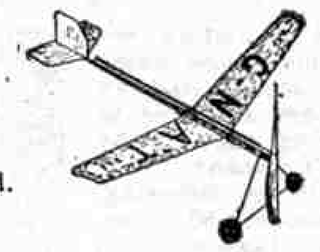

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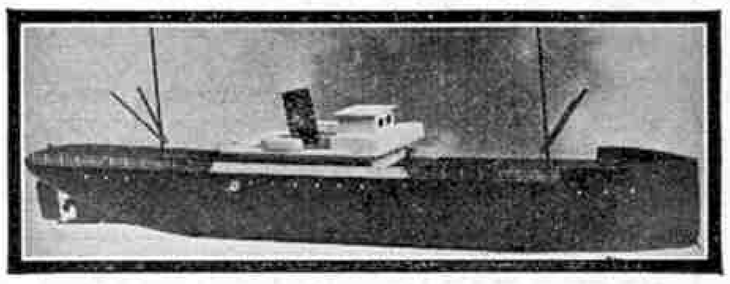

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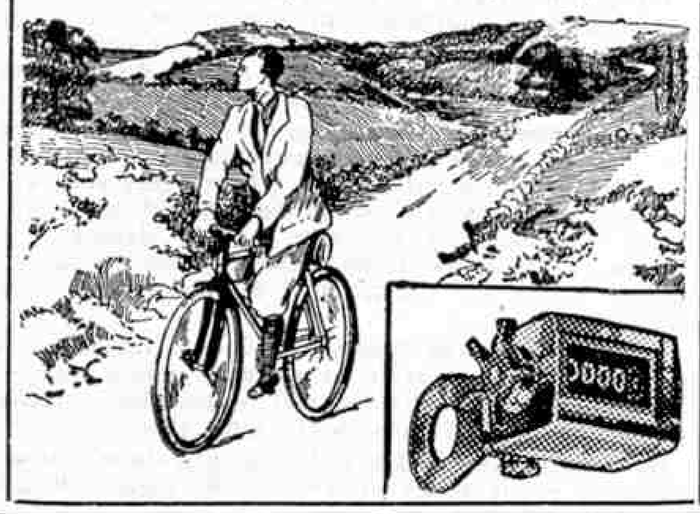

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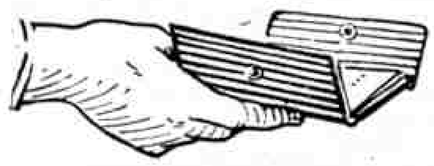

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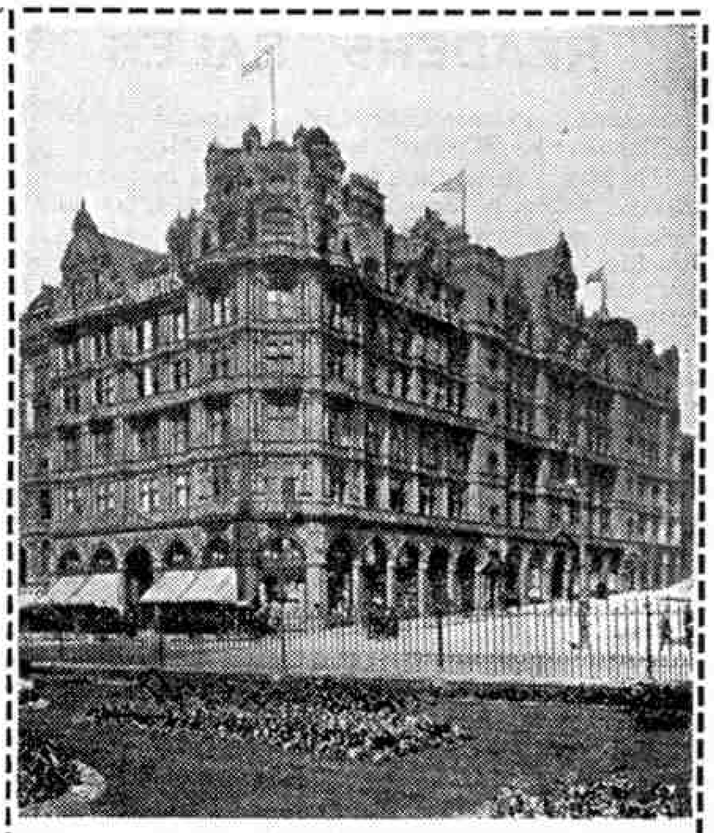

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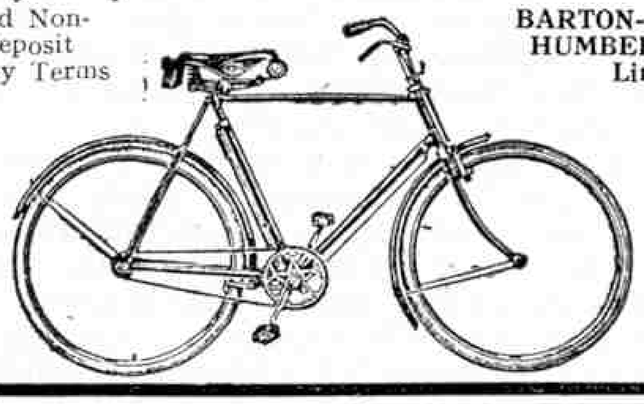

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How to Get More Fun—(*Con. from page 403*)

the Fleetwood route. At the point where this leaves the main line is placed "Poulton" station, this being named after the junction from which the Fleetwood line diverges in actual practice.

The addition of this branch greatly increases the amount of goods traffic that may correctly be run on the railway, for Fleetwood is a busy fishing port. Coal for trawlers and other vessels is hauled to it, and it also is necessary to provide a number of special fast goods trains from the port for the purpose of carrying fish to inland markets.

Other additions that may be made without disturbance to the original idea include more stations. The unnamed one shown on the layout illustrated represents in turn Poulton, Preston, and Kirkham, but more interesting working may be obtained by using separate stations for these. A second turntable in conjunction with another engine shed would enable "Manchester" and "Blackpool" to be separated more effectively, and various branch lines and alternative routes also suggest themselves as interesting additions.

April Mystery Photograph

We fear that only a thin veil of mystery covered the 17th Mystery Photograph, for within a few days of publication more than 1,000 correct solutions were received! The first came from P. F. White, 28, Grosvenor Road, Gunnersbury, London, W.4, to whom an autographed copy of my book "*Engineering for Boys*" has been sent. The photograph represented a carving fork, with guard open, seen from the "business" end.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
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Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post free).

The U.S.A. price is 15c. per copy, and the subscription rates 90c. and $1.75 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
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The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or writedirect to the Editor.

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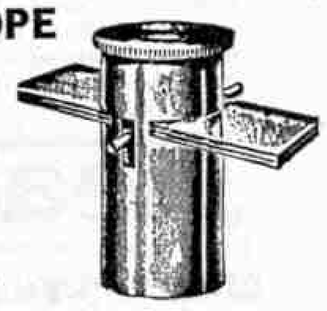

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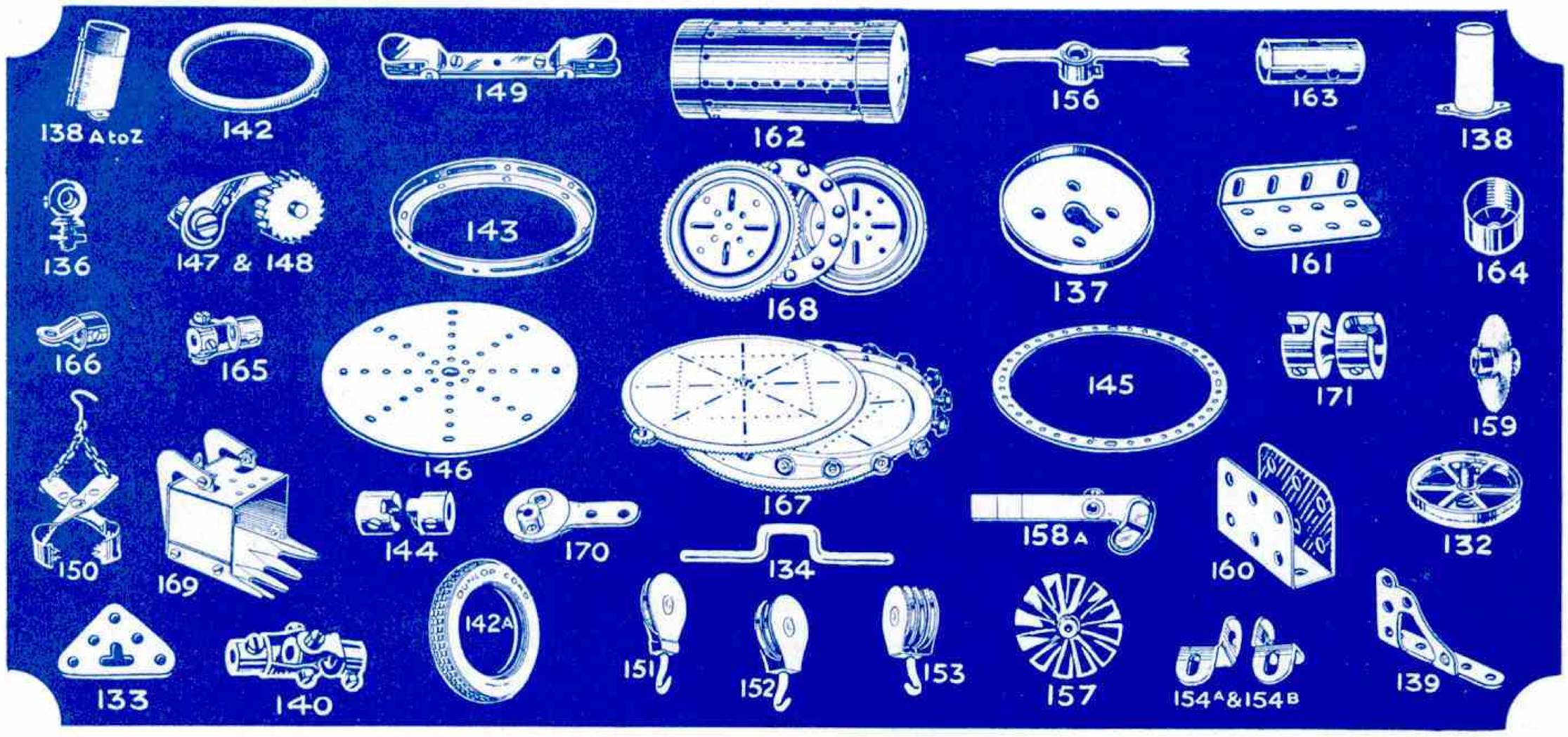

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No.		s.	d.
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154b.	„ „ „ ½", left hand „	0	6
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157.	Fans, 2" diam. ... ... „	0	4
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161.	Girder Bracket, 2" × 1" × ½" ... ... 2 for	0	3
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167a.	Roller Races, geared, 192 teeth ... „	4	6
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168a.	Ball Races, flanged disc ... ... „	0	6
168b.	„ „ toothed „ ... ... „	0	9
168c.	Ball Casings, complete with balls ... „	1	9
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170.	Eccentrics, ¼" throw ... ... „	0	9
171.	Socket Couplings ... ... „	0	9

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The above is the third and final group composed of parts 132 to 171 inclusive. The preceding groups appeared in the January and March 1930 issues of the "M.M."

A complete list of all the parts in the system may be obtained from any Meccano dealer on application.

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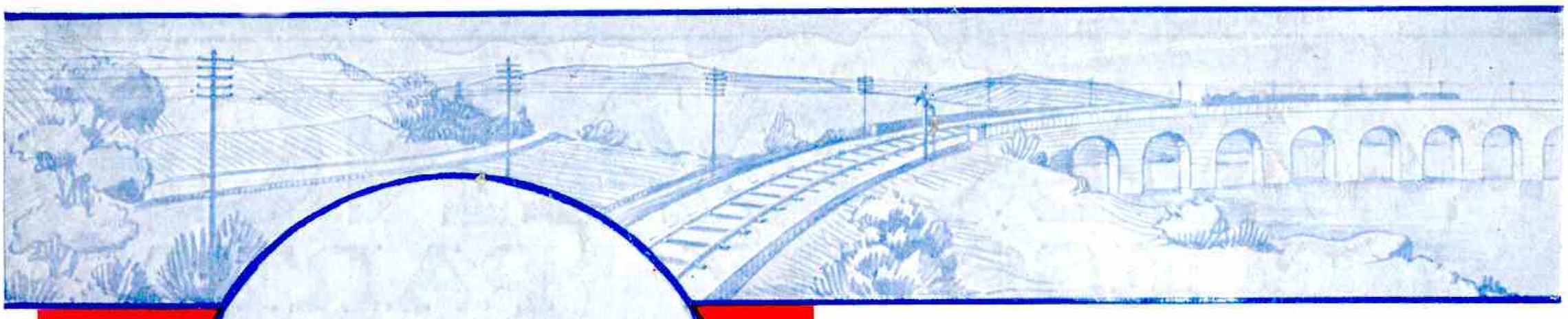
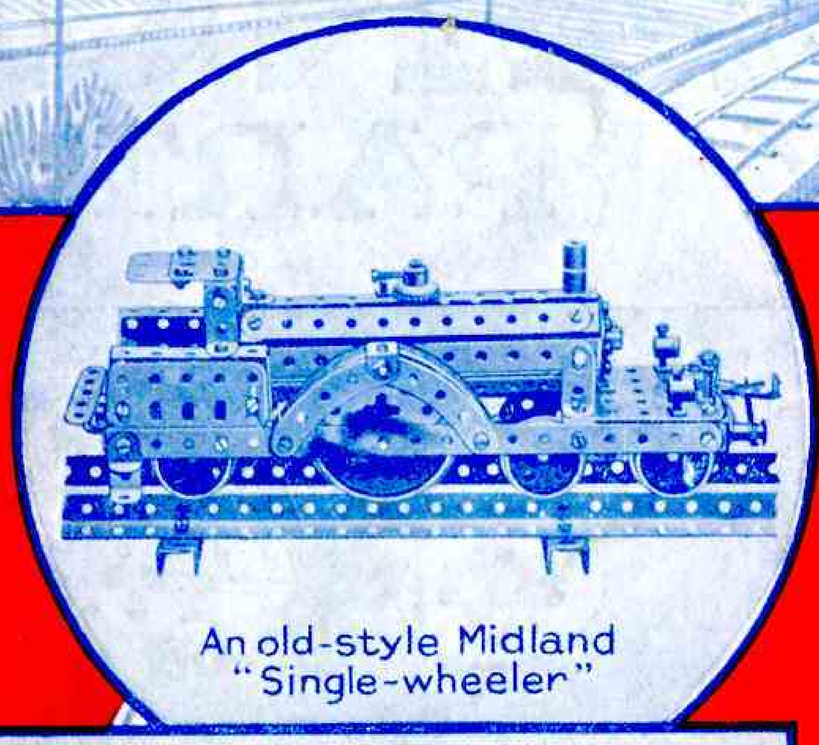
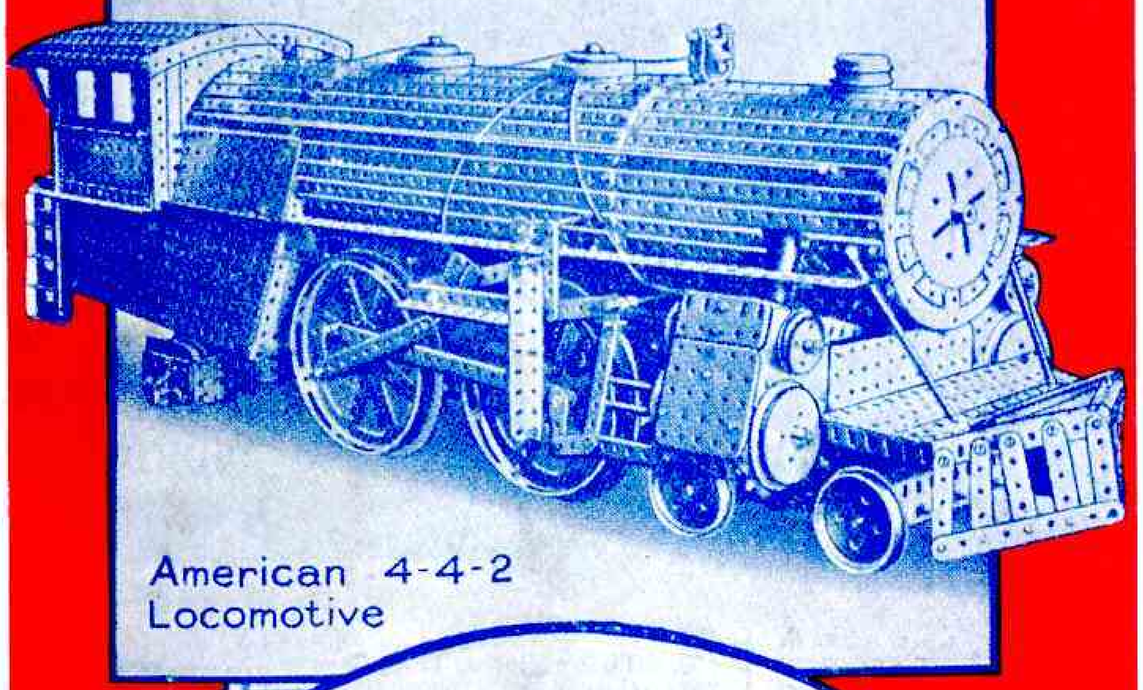
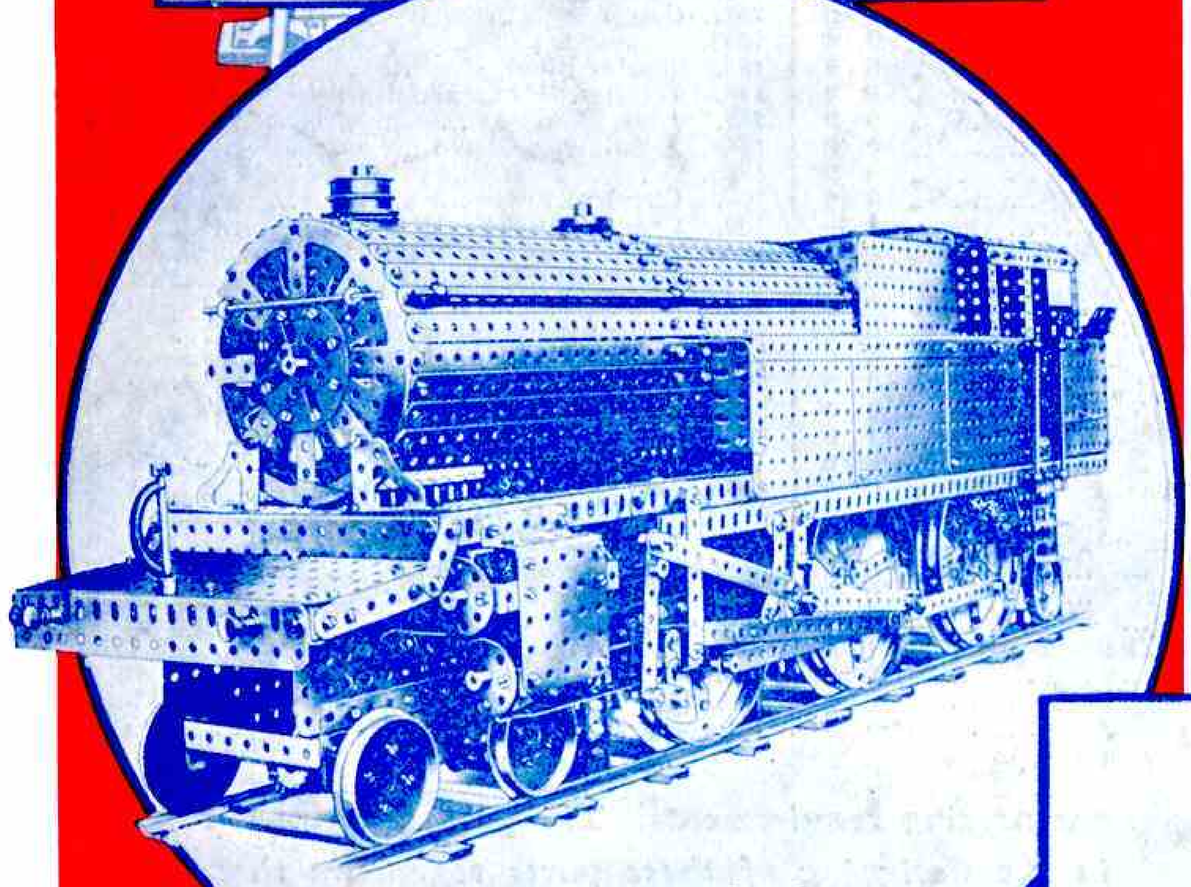




An old-style Midland "Single-wheeler"



American 4-4-2 Locomotive



A typical Meccano Tank Loco.

MECCANO

EXAMPLES OF MODEL CONSTRUCTION:

3. Transport by Rail

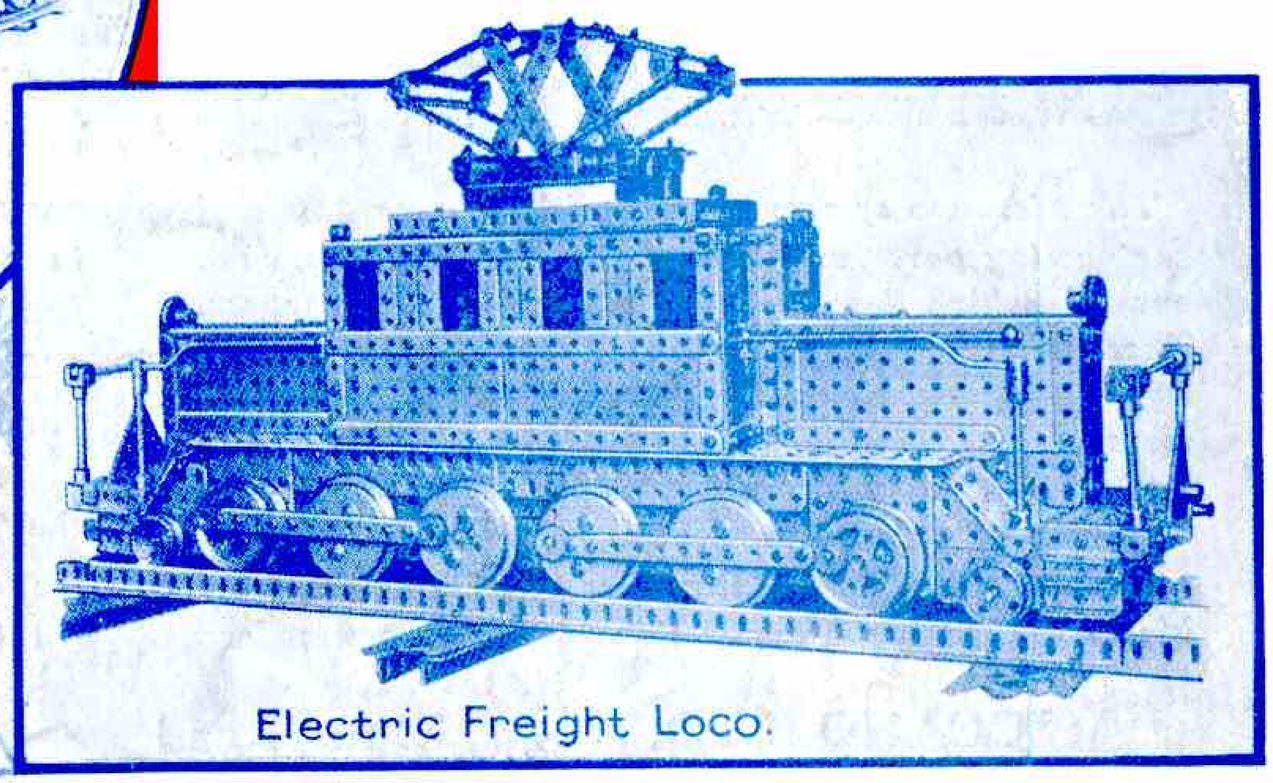
THE present-day railway system is one of the greatest triumphs of engineering. For more than a hundred years a vast network of steel rails has gradually been extending all over the country. Means of locomotion have grown more and more efficient, until to-day we are able to travel for almost any distance at a great speed and with every comfort. It is almost impossible to imagine the everyday life of the public before the introduction of railways. Because of the difficulties of travel the ordinary individual a century ago seldom travelled far from his native town or village, with the result that the countryside beyond a certain radius was as remote to him as a foreign land.

Railway Transport is represented by a number of fine Meccano models, as will be seen from the examples shown on this page. Locos made with Meccano parts are not only realistic in appearance but they may be driven by the Electric or Clockwork Motors and employed in building up complete working model railways.

The old style "Single-wheeler" illustrated forms the subject of Model No. 7.34 in the 4-7 Meccano Manual, and the Tank Loco is fully described and illustrated in Special Instruction Leaflet No. 15 (price 3d. from any Meccano dealer, or 3d. post free from Meccano Ltd.).

Meccano Outfits range in price from 3/6 to 450/- and may be obtained from all leading toy stores. Ask to see them.

MECCANO LTD., Old Swan, LIVERPOOL



Electric Freight Loco.

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